DRAFT FINAL
EXPANDED ENGINEERING EVALUATION/ COST ANALYSIS FOR THE TOSTON SMELTER SITE RADERSBURG MINING DISTRICT BROADWATER COUNTY, MONTANA

Prepared for:

Mine Waste Cleanup Bureau
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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

µg/dL	Micrograms per decaliter
µg/L	Micrograms per liter
ABA	Acid-base accounting
ABP	Acid-base potential
amsl	Above mean sea level
ARAR	Applicable or Relevant and Appropriate Requirements
ASTM	American Society of Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
ATV/MR	All-terrain vehicle/motorcycle rider
CEC	Cation exchange capacity
CECRA	Montana Comprehensive Environmental Clean-up and Responsibility Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CFR	Code of Federal Regulations
COC	Contaminant of Concern
CY	Cubic yards
EEE/CA	Expanded Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
EQ	Ecologic impact quotients
g/cm^3	Grams per cubic centimeter
HHS	Human Health Standards
HI	Hazard index
HQ	Hazard quotient
IRIS	Integrated Risk Information System
kg/day	Kilograms per day
lbs/day	Pounds per day
LOAEL	Lowest observed adverse effects level
MCL	Maximum contaminant level
MDEQ	Montana Department of Environmental Quality
meg/100g	Milliequivalent per 100 grams
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MWCB	Montana Department of Environmental Quality's Mine Waste Cleanup Bureau
(mg/kg/d)	Milligrams per kilogram per day
ms/cm	Microsiemens per centimeter
NAS	National Academy of Sciences
NCP	National Oil and Hazardous Substances Contingency Plan
NOAEL	No observed adverse effects level
OSHA	Occupational Safety and Health Administration
ppm	Parts per million
PRG	Preliminary remediation goals
PVC	Polyvinyl chloride
QA/QC	Quality assurance/quality control

ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

RCRA	Resource Conservation and Recovery Act
RfD	Reference dose
RI	Reclamation investigation
ROD	Record of Decision
SLERA	Screening-level Ecological Risk Assessment
SMP	Shoemaker, McLean, and Pratt
t/1,000t	Ton per 1,000 tons
$t_{1/2}$	Half-life
TBC	To be considered
TCLP	Toxicity characteristics leaching procedure
TSD	Treatment, storage, and disposal
TtEMI	Tetra Tech EM Inc.
USDA	U.S. Department of Agriculture

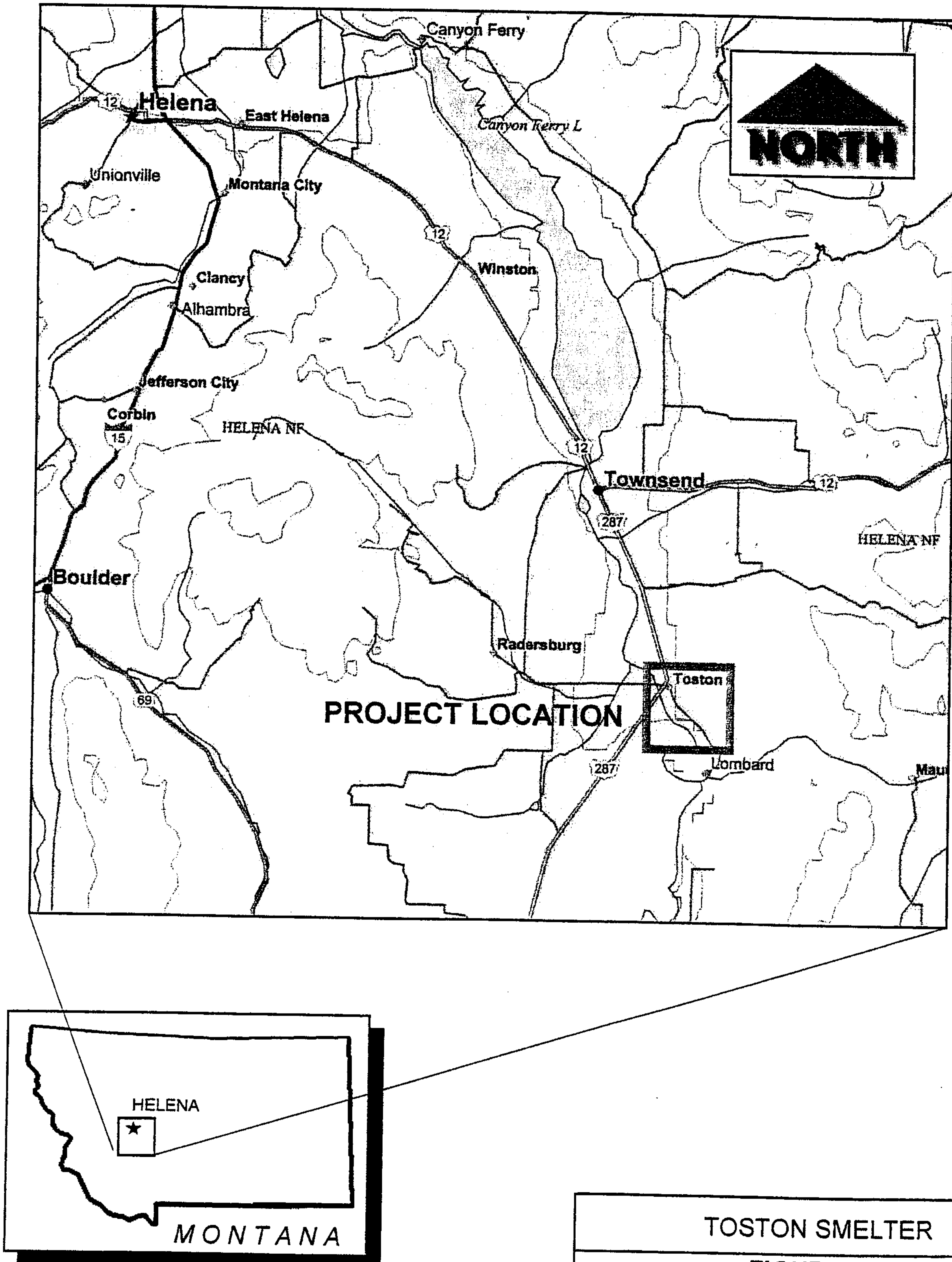
1.0 INTRODUCTION

Tetra Tech EM Inc. (TtEMI) received a task order from the Montana Department of Environmental Quality's Mine Waste Cleanup Bureau (MDEQ/MWCB) to conduct an expanded engineering evaluation/cost analysis (EEE/CA) for the Toston Smelter site. The purpose of the EEE/CA is to present a detailed analysis of reclamation alternatives that regulatory agencies can use for reclamation decision making. In addition, the analysis presents background information, waste characteristics, applicable or relevant and appropriate requirements (ARAR), a risk assessment, and the development and screening of reclamation alternatives.

The reclamation process has been designed to comply with the requirements of the National Oil and Hazardous Substances Contingency Plan (NCP); the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA); and the Montana Comprehensive Environmental Clean-up and Responsibility Act (CECRA). Certain aspects of the process have been streamlined to meet the regulatory and functional needs of cleaning up relatively small abandoned mine sites that are generally situated in remote locations. The reclamation alternatives considered for implementation at the Toston Smelter site are classified as interim or removal actions and are not necessarily considered the final reclamation remedies or alternatives. In addition, the reclamation alternatives presented in this EEE/CA are applicable to solid media only; no reclamation alternatives were developed for treatment of groundwater, surface water, or off-site stream sediments.

The Toston Smelter site is an abandoned gold, silver, and lead smelter listed on the MDEQ/MWCB priority sites list. The Toston Smelter site is located approximately 1 mile south of the townsite of Toston, Montana in the Radersburg Mining District, in Broadwater County (Figure 1-1). The Toston Smelter site is situated in Section 26, Township 5 North, Range 2 East, Montana principle meridian (Latitude N 46° 09' 30"; Longitude W 113° 26' 25"). The Toston Smelter site is comprised of approximately 10 acres on the eastern bank of the Missouri River. The MDEQ/MWCB is preparing plans for the mitigation of environmental impacts associated with the smelter wastes deposited on the alluvial bench next to the Missouri River. A portion of a slag pile is protruding into the Missouri River and forms the eastern bank of the river.

This EEE/CA report is supported by the following Toston Smelter site documents: the final reclamation work plan (TtEMI 1998b), the final sampling and analysis plans [includes the field sampling plan,



TOSTON SMELTER

FIGURE 1-1
SITE LOCATION MAP

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health and safety plan, quality assurance project plan, and laboratory analytical protocol] (TtEMI 1998c), and the draft reclamation investigation (RI) report (TtEMI 1998a).

This EEE/CA is organized into ten sections. The contents of Sections 2.0 through 10.0 are briefly described below.

Section 2.0, Background - briefly describes the Toston Smelter site, including the physical setting, mining history, climate, geology, soil, hydrology.

Section 3.0, Summary of the RI and Characterization of Waste Types - summarizes previous investigations and describes the characteristics of the site, surrounding area soil, wastes, and other key features at the Toston Smelter site.

Section 4.0, Reclamation and Land Use Characterization - summarizes the physical and chemical characteristics of the soil and wastes needed to define the reclamation alternatives and nature of contamination at the site.

Section 5.0, Summary of Site Risks - summarizes the human health risks and the ecological (environmental resources, wildlife, and others) risks associated with the site in its current (pre-reclamation) state.

Section 6.0, Summary of ARARs - presents the Montana State and Federal government ARARs, which are identified for the reclamation effort. Requirements discussed in this section are chemical-, location-, and action-specific in nature.

Section 7.0, Reclamation Objectives And Goals - presents the reclamation objectives and the applicable or relevant cleanup standards.

Section 8.0, Identification And Screening of Response Actions, Technology Types, And Process Options - presents the reclamation options that were evaluated for use at the Toston Smelter site and discusses the feasibility of these options.

Section 9.0, Detailed Analysis of Reclamation Alternatives - presents the detailed analysis of reclamation alternatives using NCP criteria.

Section 10.0, Comparative Analysis of Alternatives - presents a comparative analysis of alternatives for consistency with the NCP criteria.

2.0 BACKGROUND

Background information pertinent to the EEE/CA is discussed in the following sections. This information includes project setting, site history, geology and soil, and hydrology.

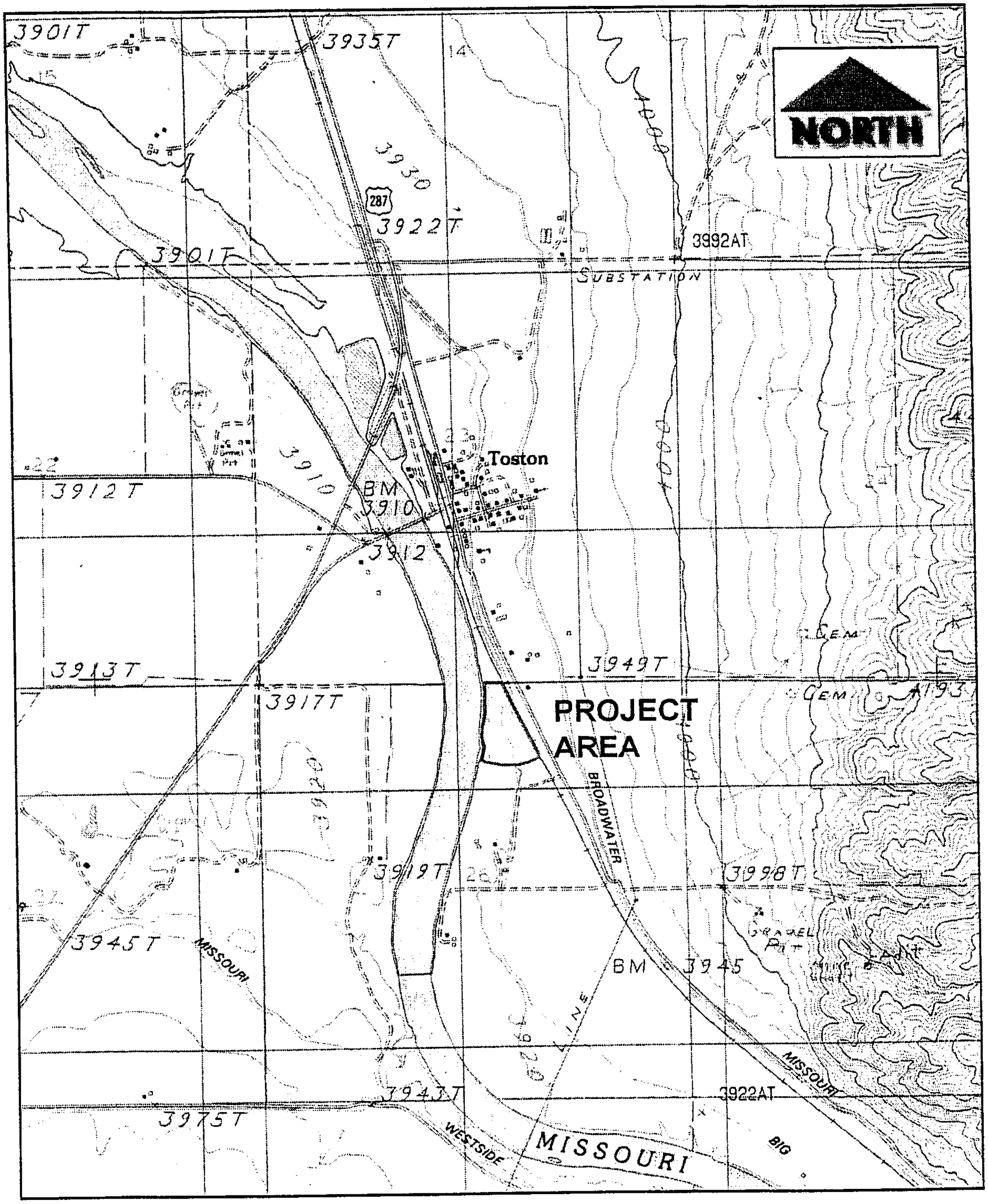
2.1 PROJECT SETTING

The site location, topography, and ownership; climate; vegetation and wildlife; and land use and population are discussed below.

2.1.1 Location and Topography

The Toston Smelter site is located approximately 1 mile south of the townsite of Toston, Montana in the Radersburg Mining District, in Broadwater County (Figure 1-1). The Toston Smelter site is situated at an elevation of approximately 3,920 feet above mean sea level (amsl) in Section 26, Township 5 North, Range 2 East, Montana principle meridian (Latitude N 46° 09' 30"; Longitude W 113° 26' 25"). The Toston Smelter site is comprised of approximately 2 acres on the eastern bank of the Missouri River. A general topographic view of the vicinity is shown in Figure 2-1. A detailed topographic map for the Toston Smelter site was prepared during the RI and is shown in Exhibit 1. Significant site features include the Missouri River on the western border of the site, an irrigation ditch (Big Springs Ditch) through the center of the site, and abandoned railroad spurs in the eastern portion of the site.

The Toston Smelter site was previously investigated in 1997 by Pioneer Technical Services as part of the State of Montana abandoned mine inventory (Pioneer 1997). Estimated waste volumes associated with the Toston Smelter site were reported to be 7,070 cubic yards (CY) of slag, 40 CY of tailings, and 220 CY of sulfide waste. The disturbed surface area was estimated at 2 acres. For the purposes of characterizing and evaluating reclamation alternatives for the Toston Smelter site, the various Toston Smelter site waste materials have been separated into three distinct types: (1) slag materials; (2) speiss materials; and (3) sulfide waste. The slag is located between the irrigation ditch and the Missouri River. One slag pile is protruding into the Missouri River. The speiss is scattered on both sides of the irrigation ditch. The largest sulfide waste piles are located along the abandoned railroad spurs in the eastern portion of the site.



SCALE: 1" = 2000 FEET

TOSTON SMELTER

FIGURE 2-1
SITE VICINITY MAP

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2.1.2 Climate

The Toston Smelter site is situated 52 miles east of the Continental Divide in the Missouri River valley at an elevation of 3,920 feet amsl. The climate of the Toston Smelter site area is a modified continental climate. The cool air and general protection provided by the surrounding mountains contribute to less seasonal variation in temperature than would be typical of a true continental climate. Average monthly temperatures for Toston, Montana range from a high of 85.2°F and a low of 47.8°F in July to a high of 32.4°F and a low of 8.4°F in January.

Precipitation is mostly in the form of snow in the winter months and snow and rain in the spring and fall. The area has a distinct spring/early summer rainy season with May and June usually the wettest months of the year. The average annual precipitation recorded in Toston, Montana is about 12 inches a year, with significantly more accumulation in the surrounding mountains.

2.1.3 Vegetation and Wildlife

The Toston Smelter site is vegetated with grasses, forbs, shrubs, and small trees. Some small areas with smelter wastes are unvegetated. The area surrounding the site is in a broad flat portion of the Missouri River valley and was part of a short grass prairie prior to its conversion to agriculture and other developed uses. The Missouri River provides habitat for rainbow trout, brown trout, whitefish, squawfish, carp, waterfowl, and fur bearers. Mule and white-tailed deer, coyotes, and pheasants may frequent the area. No threatened or endangered species are reported to frequent the area.

An inventory of plant and wildlife species of special concern has been compiled by the Montana Natural Heritage Program for the Toston Smelter site (Montana Natural Heritage Program 1998). A great blue heron rookery is located approximately 6 miles north of the site. In addition, the annual Indian paintbrush (*Castilleja exilis*) has been found approximately 2 miles northwest of the site.

The Toston Smelter site is located on the boundary of two delineated "Range Sites." The upper bench area is on the Silty Range site while the lower areas, along the Missouri River, are on the Shallow to Gravel Range site (Olsen and others 1977). The dominant plant communities for the two sites are similar with a predominance of native grasses and forbs. Under undisturbed and natural conditions, the climax (potential) plant community for the Toston Smelter site would be a Bluebunch wheatgrass, Needle-and-thread grass, Western wheatgrass, and Blue grama grassland plant community.

The dominant plant species observed growing on the Toston Smelter site include the following grass species: Bluebunch wheatgrass, Needle-and-thread grass, Western wheatgrass, Blue grama, Sheep fescue, Kentucky bluegrass, Basin wildrye, Prairie junegrass, and Sand dropseed. The main forbs and other weedy species include Yellow sweetclover, Fringed sagewort, Woods rose, Houndstongue, Curlycup gumweed, Prickly-pear cactus, Yucca, and Knapweed. The main shrub and small tree species were Skunkbush sumac and Rocky Mountain juniper.

2.1.4 Land Use and Population

The nearest community to the Toston Smelter site is the townsite of Toston, located approximately 1 mile north of the smelter. According to the Montana Department of Commerce, the community of Toston is unincorporated and, as a result, no official boundaries exist to determine exact size and population. However, as of April 1, 1990 (the date of the most recent census), approximately 120 residents live in the townsite of Toston. The primary land use in the Toston area is agricultural.

2.2 SITE HISTORY

A detailed cultural resource inventory and assessment for the Toston Smelter site has been prepared for MDEQ by GCM Services, Inc. (June 1998). In the early 1880s, large amounts of silver-gold ore was stockpiled at mines in the Radersburg Mining District because the ore was unsuitable for the wet-process mills in the area. In June 1885 construction of the Toston Smelter began. The original sandstone blast furnace was replaced with a Herreshoff cast iron, water-jacketed blast furnace in 1886. The smelter used locally obtained coal, limestone, and pyrite to fuel the smelter and flux the ores. The smelter produced matte that was shipped off site for refining and slag that was disposed of in the Missouri River. At peak production in 1888, the smelter worked around the clock reducing 100 tons of ore into one 20 ton carload of matte. By the end of 1888, the smelter ceased operation. The smelter was in existence until 1899. After 1899, the smelter was dismantled and the rail spur tracks were removed.

2.3 GEOLOGY AND SOILS

Missouri River alluvial deposits underlie the Toston Smelter site. The alluvial deposits consist of interbedded silts, sands, and gravels. The natural soils at the Toston Smelter are classified as Amesha sandy loam in the eastern portion of the site and Scravo cobbly loam in the western portion of the site (Olsen and others 1977). These soils are deep, well drained, and have formed on slopes up to 9 percent on calcarious Missouri River alluvium. The Amesha sandy loam has moderate permeability and high moisture capacity while the Scravo cobbly loam has a moderately rapid permeability and a low moisture capacity. The native soils that have been impacted by unprocessed ore are potentially acidic.

2.4 HYDROGEOLOGY

Little information is available pertaining to the hydrogeology at the Toston Smelter site. There are 133 water wells reported in the Montana Bureau of Mines and Geology database located within four miles of the site. Two domestic wells are located approximately 1,000 feet south of the site. One of these wells is not currently in use. The other well is used to supply water to a farm house. A third well is located adjacent to the Missouri River in the northern portion of the site. This well is not currently in use. The static water level in all three wells is approximately equal to the elevation of the Missouri River.

2.5 HYDROLOGY

The Missouri River forms the western boundary of the site. An irrigation ditch (Big Springs Ditch) runs north and south bisecting the site. The irrigation ditch usually contains water from May through September each year. It is approximately 6 feet deep and 8 feet wide. A small intermittent drainage that drains a small area west of the railroad tracks is located in the northern portion of the site.

3.0 SUMMARY OF THE RECLAMATION INVESTIGATION

This section describes the waste characteristics and analytical results for the Toston Smelter site including the waste types, locations, volumes, physical properties, and off-site metals analyses collected during the RI (TtEMI 1998). Characterization of the waste types was used to determine the potential risk to human health and the environment, and the final reclamation alternatives for the site. A variety of soil and mining-related waste materials was sampled during the RI. A general description of the collection of field samples, metals analyses, and data evaluation is further divided in the following subsections: (1) slag, (2) speiss, (3) sulfide wastes, (4) background soil, (5) surface water and groundwater, (6) historic sampling, and (7) waste volumes. The different waste types are mixed together in many areas of the smelter site preventing the calculation of separate volumes for each specific waste type.

The solid-matrix samples were sent to an off-site laboratory for metals analysis using SW-846 method 6010. The results of the metals analysis are listed in Table 3-1. In addition, particle size, cation exchange capacity (CEC), complete agronomic analysis, water soluble metals, toxicity characteristic leaching procedure (TCLP) metals, pH, and acid-base accounting (ABA) analyses were completed and are discussed in Section 4.0. Surface water and groundwater samples were analyzed for metals, common ions, and nitrates at an off-site laboratory. The data from the previous investigation (Pioneer 1997) are comparable to the data from the RI.

Evaluation of the laboratory results and the human health and ecological risk assessments presented in Section 5.0 suggests that the primary contaminants of concern useful for site characterization at the Toston Smelter site are arsenic, copper, lead, and zinc. The other analytes were not included in the following discussion because they were not frequently found at concentrations above the recreational cleanup guidelines or at concentrations that may pose a risk to potential ecological receptors. The analytical data presented in this section were compared to recreational cleanup levels for sites with maximum recreational use for abandoned mine sites (Tetra Tech 1996) and to screening levels of potentially phytotoxic concentrations of metals. The noncarcinogenic recreational cleanup guideline for arsenic is 323 milligrams per kilogram (mg/kg) while the carcinogenic cleanup guideline at a 10^{-4} risk level is 139 mg/kg. The recreational cleanup guidelines for the other metals are 54,200 mg/kg for copper, 2,200 mg/kg for lead, and 440,000 mg/kg for zinc. The potentially phytotoxic concentrations are 50 mg/kg for arsenic, 125 mg/kg for copper, 400 mg/kg for lead, and 400 mg/kg for zinc. Concentrations that may pose a risk to deer include 402,500 mg/kg arsenic and 314 mg/kg lead. Copper and zinc do not pose a risk to deer.

3.1 SLAG

Slag is present at the Toston Smelter site in two solid piles and as broken debris over the other portions of the site (Exhibit 1). The solid slag piles are located west of Big Springs Ditch. The southern pile consists of solid black slag with broken edges on the north and east sides. There is broken slag debris completely around the pile. The northern slag pile consists of solid black slag with a vertical broken face on the east side. The west side of the slag pile extends approximately 10 feet into the Missouri River. The majority of the scattered slag is found west of Big Springs Ditch on the bench above the river. There is an area with little or no vegetation in the north central portion of the site that has up to 2 feet of slag debris. East of Big Springs Ditch slag is found in small quantities west of the abandoned railroad

TABLE 3-1

METALS IN SOILS (mg/kg)
TOSTON SMELTER SITE

Sample Number	Sample Type	Sb	As 323	Cd	Cu	Fe	Pb 2,200	Mn 7,300	Hg	Ni	Ag	Zn
IDL	--	4.1	5.9	0.90	0.40	3.6	6.2	0.72	0.020	3.9	0.98	1.4
SS-1	Soil, trace speiss	16.7U	169	4.7	80.8	15,700	**5,340**	323	0.081	12.7	12.6	453
SS-2	Soil, trace slag	40.3J	251	7.0	244	34,500	**20,400**	538	0.082	13.9	63.8	930
SS-3	Brick debris	11.9U	**576**	4.1	37.7	11,100	**2,200**	281	0.083	12.3	4.4	131
SS-4	50% speiss, 50% soil	68.0J	**810**	8.9	173	20,300	**31,800**	644	0.33	10.1	54.3	445
SS-5	Speiss	260J	**2,140**	15.4	274	37,000	**110,000**	1,280	0.56	5.2B	157	700
SS-6	Soil, trace speiss	39.6J	**331**	5.9	73.0	20,600	**15,900**	501	0.16	12.1	27.0	191
SS-7	Soil	10.2U	**402**	5.0	80.6	19,200	**2,220**	405	0.063	11.3	6.9	240
SS-8	Soil	6.3U	**389**	3.0	35.9	20,600	631	465	0.037B	20.9	2.4	131
SS-9	Soil	22.7U	**305**	5.4	250	24,400	**7,160**	192	0.10	12.7	26.3	738
SS-10	Soil	10.9U	177	4.0	157	22,600	2,110	481	0.051	17.0	5.1	157
SS-11	Sulfide	18.4U	**29,600**	44.2	12.6	320,000	649	20.5	0.035B	5.1B	21.9	18.8
SS-12	Soil	12.8U	**536**	6.0	74.7	26,600	**2,680**	560	0.11	20.5	6.7	179
SS-13	Slag	120	302	0.88U	1,840	133,000	**5,040**	436	0.079	3.8U	124	8,120
SS-14	Red clay	6.1B	14.7	0.78U	24.8	9,990	35.2	295	0.018U	10.5	0.92B	45.4
SS-15	Soil	7.3B	179	2.0	101	16,600	790	372	0.056	10.2	2.3	249
SS-16	Soil	5.1U	30.4	0.75U	18.1	10,600	870	313	0.019B	10.5	11.1B	58.3
BP-5-1.5	Soil below sulfide	6.8U	32.2	4.1	31.3	19,900	83.6	506	0.024B	17.1	0.91U	124
BP-8-3	Soil below slag	6.3U	15.4	2.1	29.6	14,800	121	431	0.022B	17.7	0.92U	76.8
BP-12-2.5	Soil below slag/speiss	3.9U	17.4	1.4	16.6	14,000	196	404	0.050	17.9	0.92B	56.9
BP-17-0.5	Soil below sulfide/speiss	9.1U	**587**	11.8	186	84,400	374	175	0.042B	7.7B	2.5	84.2
BP-18-2.5	Soil below sulfide	6.6U	**652**	6.7	49.8	46,400	1,040	71.6	0.057	4.4B	3.6	101
BP-21-1.5	Green mottled sand above native soil	674J	**3,650**	85.9	6,560	171,000	**108,000**	244	1.9	6.7B	168	11,500

TABLE 3-1

METALS IN SOILS (mg/kg)
TOSTON SMELTER SITE
(Continued)

Notes:

--	Not applicable
IDL	Instrument Detection Limit
mg/kg	Milligrams per kilogram
U	Nondetect
J	Estimated concentration
B	Concentration between the instrument detection limit and the contract reporting limit.

Bold/shaded values are concentrations that exceed the recreational cleanup guideline (Tetra Tech 1996)

Sb	Antimony	As	Arsenic	Cd	Cadmium
Cu	Copper	Fe	Iron	Pb	Lead
Mn	Manganese	Hg	Mercury	Ni	Nickel
Ag	Silver	Zn	Zinc		

sidings. The slag debris is dense and black with some vesicles. The various individual debris pieces range in size from sand size (0.5 to 2 millimeters) to cobble size (15 centimeters).

One sample (SS-13) was collected from the slag debris found east of the southern solid slag pile. The sample contained 5,040 mg/kg of lead, well above the recreational cleanup guideline of 2,200 mg/kg. Another sample (SS-2) was collected from the surface soil with a trace amount of slag and contained 20,400 mg/kg lead. Complete analytical results are listed in Table 3-1. The samples indicate that the area with solid slag and with scattered slag debris likely contains lead at concentrations that exceed the recreational cleanup guideline. In addition, the more weathered and finer-textured materials that contain slag may have higher concentrations of extractable lead and other metals. Sample BP-8-3 was collected from the soil below the slag. It did not contain any metals above the recreational cleanup guideline.

3.2 SPEISS

Speiss is present at the Toston Smelter site as broken debris over much of the site. The speiss, as defined in this report, is flash cooled slag from the smelting process. It is friable, very vesicular, and has a very low bulk density (1.0 to 1.2 grams per cubic centimeter [g/cm^3]. West of Big Springs Ditch the speiss deposits are located in the northern half of the area with the thickest deposits (approximately 1.5 feet) on the slopes below the edge of the ditch. East of Big Springs Ditch the speiss is present as thin deposits (less than 1 foot) over the area west of the eastern railroad spur. It was originally thought that the speiss was coke. However, the speiss contains high concentrations of metals and low organic carbon content indicating that it is not a coke or coal product.

Sample SS-5 was collected from a pile of crushed speiss west of Big Springs Ditch. The sample contained 2,140 mg/kg arsenic and 110,000 mg/kg lead, well above the recreational cleanup guidelines of 323 mg/kg and 2,200 mg/kg, respectively. Sample SS-4 contained approximately 50 percent soil and 50 percent speiss. The sample contained 810 mg/kg arsenic and 31,800 mg/kg lead. Both concentrations are above the recreational cleanup guidelines of 323 mg/kg and 2,200 mg/kg, respectively. Samples SS-1 and SS-6 were collected from soil that contained a trace (less than 10 percent) amount of speiss. Sample SS-1 contained lead (5,340 mg/kg) at a concentration above the recreational cleanup guideline of 2,200 mg/kg. Sample SS-6 contained arsenic (331 mg/kg) and lead (15,900 mg/kg) at concentrations above the recreational cleanup guidelines of 323 mg/kg and 2,200 mg/kg, respectively. Complete analytical results are in Table 3-1. The sample results suggest that the speiss contains very high concentrations of lead and elevated concentrations of arsenic. The speiss is very friable and can be easily crushed; the fine-grained fragments can be transported by the wind to unimpacted areas.

3.3 SULFIDE WASTES

The largest deposits of sulfide wastes are found along the railroad spurs east of Big Springs Ditch (Exhibit 1). West of Big Springs Ditch the sulfide wastes are thin (less than 1 foot thick) piles or is pyrite scattered on the surface. These wastes are composed of decayed ore or of the pyrite used to help fuel the smelter. The largest sulfide waste piles east of Big Springs Ditch contain large quantities of pyrite. The surface of the piles is coated with pyrite that has weathered out of the rock. The deeper portions of the piles are pyrite rich weathered volcanic rock.

Sample SS-11 was collected from one of the larger piles of sulfide waste east of Big Springs Ditch. It contained 29,600 mg/kg arsenic, well above the recreational cleanup guideline (323 mg/kg). Sample BP-21-1.5 represents a small deposit of material that is substantially different from all the other sulfide-rich wastes found at the site. Sample BP-21-1.5 was collected from a green mottled sand found above the native material (Exhibit 1). It contained the highest concentrations of antimony (674 mg/kg), cadmium (85.9 mg/kg), copper (6,560 mg/kg), silver (168 mg/kg), and zinc (11,500 mg/kg) found at the site. It also contained arsenic (3,650 mg/kg) and lead (108,000 mg/kg) at concentrations above the recreational cleanup guidelines (323 mg/kg and 2,200 mg/kg, respectively).

Sample BP-5-1.5 was collected from soil buried below a pile of sulfide waste located west of Big Springs Ditch. The waste was relatively thin and contained siliceous ores. The sample did not contain metals at concentrations above the recreational cleanup guidelines. Sample BP-17-0.5 was collected below the mixed speiss and sulfide waste located at the north end of the site west of Big Springs Ditch. The sample contained arsenic (587 mg/kg) at a concentration above the recreational cleanup guideline (323 mg/kg). Sample BP-18-2.5 was collected from soil below a deposit of weathered pyrite rich volcanic rock east of Big Springs Ditch. The sample contained arsenic (652 mg/kg) above the recreational cleanup guideline (323 mg/kg). Table 3-1 contains the complete analytical results.

The analytical results suggest that the sulfide rich wastes contain very high concentrations of arsenic and that the arsenic has leached into the native soil below the waste. The sulfide-rich wastes do not contain concentrations of other metals that may pose a risk to potential receptors.

3.4 BACKGROUND SOIL

Background soil samples were collected to determine the ambient concentration of metals in surface soils in the vicinity of the Toston Smelter site. Two background samples were collected north and east of the site. A third background sample was collected south of the site during the site assessment. Exhibit 1 shows the sample collection locations and Table 3-2 presents the analytical results. All three samples were analyzed for metals at an off-site laboratory. The background sample (BG-2) collected north of the site contained a high concentration of lead (7,910 mg/kg) suggesting that the area has likely been impacted by wind blown speiss. Another background sample (BG-4) was collected north of the site to replace sample BG-2.

Evaluation of the data from the subsurface soil samples and other background samples suggests that the background concentrations of arsenic and lead are at least an order of magnitude lower than the respective recreational cleanup guidelines. The background concentrations for the other metals are also below the recreational cleanup guidelines.

3.5 SURFACE WATER AND GROUNDWATER

Samples of surface water from the Missouri River upstream and downstream of the site and groundwater from the three wells closest to the site were collected in April 1998. The samples were analyzed for metals and water quality parameters. Table 3-3 contains the analytical results. The arsenic concentration in samples from the Helm domestic well and the Missouri River exceed the WQB-7 human health water quality standard for arsenic (18 micrograms per liter [μg/L])(MDEQ 1995). The grab sample from the squatter's well exceeded the WQB-7 human health water quality standards for iron (300 μg/L) and manganese (50 μg/L). The sample collected from the squatter's well was very turbid compared to the other groundwater samples. The turbidity likely contributed to the elevated iron and manganese concentrations. The samples from the hand dug Helm well and the Missouri River downstream from the site exceeded the WQB-7 human health water quality standards for mercury (0.14 μg/L). However, the mercury results from all the samples indicate that the exceedances are likely due to analytical variability and that the results from all the samples are near the human health standard (0.14 μg/L).

The measured differences in metals concentrations in the Missouri River samples collected upstream and downstream of the site are within the range of normal analytical variability. This suggests that the Toston Smelter site is not producing a measurable change in the concentration of metals in the river.

TABLE 3-2

BACKGROUND SOIL METAL CONCENTRATIONS (mg/kg)
TOSTON SMELTER SITE

Sample Identification	Matrix	Sb antimony	As arsenic	Cd cadmium	Cu copper	Fe iron	Pb lead	Mn manganese	Hg mercury	Ni nickel	Ag silver	Zn zinc
Background[a]	Soil	5.1 J	12.1 J	0.89 U	17.2	15,400	204	439	0.026 UJ	NA	0.74	49.5
BG-2	Soil	23.4	256	5.3	60.1	17,900	**7,910**	449	0.13	10.7	13.4	212
BG-3	Soil	3.9U	37.9	3.3	57.7	16,300	890	447	0.050	15.8	4.3	98.5
BG-4	Soil	5.3	31.8	0.76U	21.6	11,500	674	306	0.029	12.2	1.1	56.3

Notes:

a — Sample was collected during the preliminary site investigation (Pioneer 1997)
mg/kg — Milligrams per kilogram
NA — Not analyzed
J — Estimated concentration
U — Nondetect
UJ — Estimated nondetect

Bold/shaded values are concentrations that exceed the recreational cleanup guideline (Tetra Tech 1996)

TABLE 3-3

SURFACE WATER AND GROUNDWATER ANALYTICAL RESULTS TOSTON SMELTER SITE

Analyte	Hand-Dug Helm Well	Helm Domestic Well	Squatter's Well	Missouri River Upstream[a]	Missouri River Downstream[a]
Antimony (µg/L)	<25.9	<25.9	<25.9	<25.9	<25.9
Arsenic (µg/L)	15.0	**19.3**	<1.4	**21.3**	**23.2**
Cadmium (µg/L)	0.55	<0.075	<0.071	<0.073	<0.085
Chromium (µg/L)	<9.6	<9.6	<9.6	<9.6	<9.6
Copper (µg/L)	3.1	5.8	<2.2	3.4	2.5
Iron (µg/L)	24.2	32.2	**15,300**	77.8	85.8
Lead (µg/L)	1.4	2.3	1.3	<1.3	<1.3
Manganese (µg/L)	<4.4	<4.4	**61.5**	21.3	21.3
Mercury (µg/L)	**0.14**	0.12	0.11	0.11	**0.20**
Nickel (µg/L)	<15	<15	<15	<15	<15
Silver (µg/L)	<4.1	<4.1	<4.1	<4.1	<4.1
Zinc (µg/L)	35	57.8	14.8	35.5	25.3
Alkalinity (mg/L as $CaCO_3$)	182	166	58	143	142
Chloride (mg/L)	12	10	10	10	10
Sulfate (mg/L)	44	36	29	33	33
Hardness (mg/L as $CaCO_3$)	231	190	63.9	160	159
Specific Conductivity (ms/cm)	503	433	234	385	NA
Temperature (°C)	8.3	9.8	4.9	8.0	NA
pH	7.24	7.09	8.22	7.89	NA

Notes:

Bold/shaded values exceed Circular WQB-7 human health water quality standards (MDEQ 1995)

[a]	Sample was filtered to 0.45 microns in the field	$CaCO_3$	Calcium Carbonate
NA	Not analyzed	ms/cm	Microsiemens per centimeter
µg/L	Micrograms per liter	°C	Degrees Celsius
mg/L	Milligrams per liter		

The concentrations of metals in groundwater near the site are comparable to the concentration of metals in the Missouri River. This suggests that the site has not measurably impacted the nearby wells.

3.6 HISTORIC SAMPLING

A preliminary site assessment was completed at the Toston Smelter site in August 1997 (Pioneer 1997). Three samples of slag, two samples of sulfide waste (one was incorrectly labeled as tailings), two samples of sediment, and one background sample were collected during the investigation. The analytical results are presented in Table 3-4 except for the background sample that is included the Section 3.4 and Table 3-2. The slag samples contained arsenic at concentrations ranging from 257 mg/kg to 1,580 mg/kg and lead at concentrations ranging from 13,200 mg/kg to 130,000 mg/kg. These results are similar to the RI results for slag and speiss. The two samples of sulfide waste contained arsenic at concentrations ranging from 757 mg/kg to 16,700 mg/kg and lead at concentrations ranging from 593 mg/kg to 11,800 mg/kg. The arsenic results are similar to the RI investigation results for the sulfide waste. The lead concentration (11,800 mg/kg) in sulfide waste sample TP-1 is higher than is typical for the sulfide waste. The area where sample TP-1 was collected is littered with speiss which may account for the elevated lead concentrations.

The sediment samples were collected upstream (sample 04-505-SE-1) and downstream (sample 04-505-SE-2) of the site. Neither sample contained any metal at concentrations above the recreational cleanup guideline. The sample collected downstream contained slightly higher concentrations of metals than the sample collected upstream suggesting that the site may impact the Missouri River.

3.7 WASTE VOLUMES

Waste volumes were calculated for the Toston Smelter site for different areas impacted by the wastes. Separate volumes for slag, speiss, and sulfide wastes could not be calculated because the different wastes were found mixed together in many places. West of Big Springs Ditch the volumes of the solid slag piles are estimated at 460 CY for the northern pile and 114 CY for the southern pile. West of the ditch the total volume of slag, speiss, and sulfide debris estimated at 5,400 CY. East of the ditch the total volume of slag, speiss, and sulfide debris estimated at 1,500 CY.

TABLE 3-4

HISTORIC METALS ANALYTICAL RESULTS (mg/kg)
TOSTON SMELTER SITE

Sample Identification	Matrix	Sb antimony	As arsenic	Cd cadmium	Cu copper	Fe iron	Pb lead	Mn manganese	Hg mercury	Ag silver	Zn zinc
LABORATORY ANALYSIS (mg/kg)											
04-505-SL-1	Slag	332 J	**1,580 J**	7.2	295	33,500	**130,000**	790	0.61 J	209	2,860
04-505-SL-2	Slag	51.7 J	257 J	0.87 U	833	137,000	**13,200**	910	0.13 J	79.4	5,430
04-505-SL-3	Slag	38.5 J	**377 J**	1.1 U	219	30,000	**14,600**	307	0.076 J	39.5	350
04-505-SE-1	Sediment	5.4 UJ	6.0 UJ	1.1 U	5.2	10,200	11.2	144	0.027 UJ	0.58 U	31.2
04-505-SE-2	Sediment	8.3 UJ	9.2 UJ	1.6 U	21.2	16,200	31.3	306	0.047 J	0.90 U	78.7
04-505-WR-1	Sulfide Waste	4.5 UJ	**16,700 J**	0.89 U	18.2	287,000	593	3.0	0.11 J	14.3	41.8
04-505-TP-1	Sulfide Waste	42.1	**757 J**	0.99 U	406	72,400	**11,800**	265	0.16 J	36.1	120

Notes:

J Estimated concentration
U Nondetect
UJ Estimated nondetect
mg/kg Milligrams per kilogram

Bold/shaded values are concentrations that exceed the recreational cleanup levels (Tetra Tech 1996)

Source: Hazardous Materials Inventory (Pioneer 1997)

4.0 RECLAMATION AND LAND USE CHARACTERIZATION

Physical and chemical characteristics of the soils and mining-related wastes are needed to define the reclamation alternatives and the nature of contamination at the site. Visual observations indicate that portions of the smelter site are unvegetated and sample analysis indicates that metals are present in the smelter waste and surrounding soil at potentially phytotoxic concentrations. Other physical and chemical matrix effects, however, are more likely responsible for the lack of vegetation in some areas. The calcarious parent materials and non-acidic speiss and slag may be creating higher solid-matrix pH values which will also directly affect the availability of the metals to plants. Selected samples from the smelter site were analyzed for particle size, CEC, agronomic analysis, water soluble metals, TCLP metals, pH, and ABA.

Results from these reclamation analyses are discussed below. These analyses were used to evaluate the requirements for revegetation of all areas of the site. The reclamation analyses may be used to determine the water holding capacity of the smelter waste and soil, potential for phytotoxic concentrations, the acid generating capacity of the smelter waste, and the type and amount of amendments (lime, organic matter, and others) required to ameliorate toxic and inhibitory smelter waste conditions. Agronomic analyses are indicators of plant nutrient availability and fertility potential in soils.

Potential locations for a smelter waste repository and potential sources of top soil, cover soil, and clay were evaluated during the RI. A discussion of potential repository locations and potential borrow sources is presented after the discussion of the reclamation analyses.

Particle Size Analysis

Particle size analysis is a measurement of the size distribution of individual particles in a solid matrix sample. Particle size distribution is used to determine the texture and to predict hydraulic properties such as water holding capacity and unsaturated hydraulic conductivity. Texture is defined as the percentage of particles (less than 2 millimeter diameter) that are in the three major size groups: sands, silts, and clays. The coarse-fragment content is the percentage (mass basis) of the sample that is retained on a 2 millimeter sieve.

Particle size analyses were performed on five samples from the Toston Smelter site and the results are listed in Table 4-1. Sample SS-4 was collected from mixed waste and soil while all the other samples

TABLE 4-1

PARTICLE SIZE
TOSTON SMELTER SITE

Field ID	Matrix	Grain Size				Coarse (%)
		Sand (%)	Silt (%)	Clay (%)	Texture	
SS-4	50% speiss, 50% slag	86.25	8.75	5.00	Sand	9.4
SS-6	Soil trace speiss	65.00	26.25	8.75	Sandy Loam	5.5
SS-9	Soil	57.50	23.75	18.75	Sandy Loam	1.9
BP-12-2.5	Soil below slag/speiss	53.75	36.25	10.00	Sandy Loam	6.6
BP-18-2.5	Soil below sulfide	43.75	36.25	20.00	Sandy Loam	14.8

were collected from native soil. The percent coarse fragments ranged from 1.9 percent (sample SS-9) to 14.8 percent (sample BP-18-2.5). The fine fragments contained from 43.75 percent (sample BP-18-2.5) to 86.25 percent (sample SS-4) sand, 8.75 percent (sample SS-4) to 36.25 percent (samples BP-12-2.5 and BP-18-2.5) silt, and 5.0 percent (sample SS-4) to 18.75 percent (sample SS-9) clay. The soil in sample SS-4 will require amendment to improve water holding capacity. The other materials have adequate water holding capacity.

Cation Exchange Capacity

CEC is a measure of the quantity of readily exchangeable cations neutralizing the negative charge in the smelter waste or soil. CEC aids in the evaluation of the potential for phytotoxicity based on the exchangeability of metals in the smelter waste or soil. The negative charges are derived primarily from isomorphous substitution within clay minerals and broken bonds at the mineral edges and surfaces. Isomorphic substitution creates a permanent charge and is independent of the pH. The mineral edge charge, however, is variable and depends on pH and other properties. Coarse-textured (sandy) smelter wastes or soils generally have lower CECs than fine-textured (clayey) smelter wastes or soils. Likewise, clay soil dominated by 1:1-type silicate clays and iron and aluminum oxides will have much lower CECs than clay soil dominated by 2:1-type smectite clays.

CEC analysis was performed on five samples from the Toston Smelter site. The results are presented in Table 4-2. The CECs of the samples ranged from 8.4 to 78.6 milliequivalents per 100 grams (meq/100g). The low to moderate CEC of the materials in samples SS-4, SS-6, SS-9, and BP-12-2.5 indicates that they have a low to moderate capacity to adsorb phytotoxic metals. The CEC of sample BP-18-2.5 was 78.6 meq/100g indicating that the soil, which has 20 percent clay, would have a moderate to high capacity to adsorb phytotoxic metals.

TABLE 4-2

CATION EXCHANGE CAPACITY (CEC)
TOSTON SMELTER SITE

Sample Identification Number	Waste Type	meq/100g
SS-4	50 % speiss, 50% soil	8.4
SS-6	Soil with 10 percent speiss	10.6
SS-9	Soil	13.5
BP-12-2.5	Soil below slag/speiss	21.9
BP-18-2.5	Soil below sulfide	78.6

Notes: meq/100g Milliequivalents per 100 grams of soil

Agronomic Analysis

Complete agronomic or agricultural analysis is used to evaluate a smelter waste or soil's potential fertility and plant nutrient availability. Agronomic analyses include pH, nitrate, sodium, sulfate, salt hazard (conductivity), texture, lime, potassium, organic material, and available phosphorus. Agronomic analyses are conducted on smelter waste and soils to determine the potential for *in situ* revegetation and to calculate the amount of lime fertilizer and other amendments that may be needed.

Five samples were collected for agronomic analysis. The results of the agronomic analyses indicate that the surface soils have high organic content and relatively high nutrient content. The subsurface soils have low organic content and low nutrient content indicating that they would require the addition of amendments prior to revegetation.

Water Extractable Metals

The water extractable metals were measured using American Society of Testing and Materials (ASTM) method D3987. Water extractable metal concentrations can be used to approximate the amount of metals that are plant available. It is also used to estimate the amount of metals that could leach from the waste once it is placed in a repository. Four samples were collected for water extractable analyses. The results from the water extractable metals analyses are presented in Table 4-3. The sample of speiss (SS-5) had a high leachable arsenic concentration and a very high leachable lead concentration. The sample of sulfide (SS-11) also had a high leachable arsenic concentration and a moderate leachable lead concentration. The soil (SS-2) and slag (SS-13) had moderate leachable lead concentrations. The moderate to high leachable arsenic and lead concentrations indicate that metals may be plant available and may inhibit plant growth. They also indicate that repository leachate would likely contain elevated concentrations of arsenic and lead.

Toxicity Characteristic Leaching Procedure

TCLP is a method for evaluating the mobility of inorganic contaminants present in liquid, solid, and multi-phased wastes. The TCLP test was developed by the U.S. Environmental Protection Agency (EPA) to identify characteristics of wastes and determine specific treatment standards associated with land disposal. The TCLP procedure is provided in EPA Publication SW-846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" method 1311 (EPA 1990). The procedure

TABLE 4-3

WATER EXTRACTABLE METALS (µg/L)
TOSTON SMELTER SITE

Sample Number	Matrix	Sb	As	Cd	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn
IDL	--	20.7	29.4	4.5	2.0	18.1	30.9	3.6	0.080	19.3	4.9	7.1
SS-2	Soil, trace slag	47.1B	75.5	4.5U	65.8	5,830	2,970	154	1.4	19.3U	26.0	393
SS-5	Speiss	125	395	28.2	86.4	2,460	31,300	731	1.7	19.3U	157	857
SS-11	Sulfide	20.7U	951	29.3	13.4B	218,000	3,160	126	0.84	72.8	12.9	84.4
SS-13	Slag	131	49.5B	4.5U	326	14,500	2,080	44.4	0.18B	19.3U	19.6	794

Notes:

--	Not applicable
IDL	Instrument Detection Limit
µg/L	Micrograms per liter
U	Nondetect
B	Concentration between the instrument detection limit and the contract required reporting limit.

Sb	Antimony	As	Arsenic	Cd	Cadmium
Cu	Copper	Fe	Iron	Pb	Lead
Mn	Manganese	Hg	Mercury	Ni	Nickel
Ag	Silver	Zn	Zinc		

involves an 18-hour extraction of a sample and uses different leaching solutions depending on the nature of the waste being tested. The contaminant concentrations from the TCLP test are compared to the maximum concentration of contaminants (Title 40 of the *Code of Federal Regulations* [40 CFR], Part 261.24, Table 1) to determine if the waste may be classified as a hazardous waste. However, the slag, speiss, sulfide, and soil wastes at the Toston Smelter site are excluded as hazardous waste under the Bevill Amendment. The TCLP test was conducted to determine the potential for metal leaching problems associated with an on-site landfill alternative and off-site disposal options. A sample was also collected of the smelter brick which is not exempt under the Bevill Amendment.

Seven samples were analyzed for TCLP metals. The results are summarized in Table 4-4. Sample B-1 was a brick with slag coating one side. The sample did not contain any leachable metal concentrations in excess of the regulatory standards. Therefore, the brick is not a hazardous waste. The leachable lead concentrations in samples SS-2 (soil, 5.58 milligrams per liter [mg/L]), SS- 5 (speiss, 319 mg/L), SS-11 (sulfide, 15.8 mg/L), and SS-13 (slag, 23.4 mg/L) exceed the regulatory limit of 5.0 mg/L for lead. The leachable arsenic concentration in sample SS-11 (sulfide, 9.51 mg/L) exceeded the regulatory limit of 5.0 mg/L for arsenic. The relatively high leachable metals concentrations indicate that the preferred reclamation alternative should isolate the waste or modify the smelter waste chemical characteristics to reduce the potential metal mobility.

Smelter Waste pH Analysis

Double buffer Shoemaker, McLean, and Pratt (SMP) analysis was performed on five samples. The SMP results are presented in Table 4-5. The SMP method provides a quick measure of the smelter waste pH before and after the addition of two buffers. The results are used to determine smelter waste acidity which can be used to calculate smelter waste liming requirements. The acidity calculation from the SMP method does not include potential acidity stored in unweathered sulfides. The pH of the sulfide sample (SS-11) and the sample collected immediately below the sulfide (BP-18-2.5) had pH values of 1.57 and 2.68 respectively. The sulfide waste would require 162 tons of lime per 1,000 tons of soil (t/1,000t) while the soil below the sulfide would require 15.0 t/1,000t. The pH of the soil (sample SS-2), speiss (sample SS-5), and soil below the slag/speiss (sample BP-12-2.5) ranged from 6.17 to 8.01. None of these materials would require the addition of lime.

TABLE 4-4

METALS IN TCLP EXTRACTS (µg/L)
TOSTON SMELTER SITE

Sample Number	Matrix	As	Ba	Cd	Cr	Pb	Hg	Se	Ag
IDL	--	0.0294	0.0016	0.0045	0.0092	0.0309	0.000080	0.0416	0.0049
Regulatory Limit	--	5.0	100	1.0	5.0	5.0	0.2	1.0	5.0
B-1	Smelter brick	0.53	0.20	0.049	0.01U	4.5	0.0001U	0.042U	0.008B
SS-2	Soil, trace slag	0.308	0.401	0.0091	0.0161	**5.580**	0.00057	0.0416U	0.0095B
SS-5	Speiss	0.0775	0.0303B	0.113	0.0092U	**319.000**	0.00084	0.0416U	0.007B
SS-11	Sulfide	**9.510**	0.0913B	0.0144	0.0092B	**15.800**	0.00062	0.0416U	0.0066B
SS-13	Slag	0.265	0.305	0.0045U	0.0124	**23.400**	0.00029	0.0416U	0.0116
BP-12-2.5	Soil below slag/speiss	0.0854	0.335	0.0045U	0.0092U	0.0657	0.00073	0.0416U	0.0049U
BP-18-2.5	Soil below sulfide	0.0294U	0.0722B	0.0086	0.0098B	0.172	0.0037	0.0416U	0.0049U

Notes:

-- Not applicable
µg/L Micrograms per liter
U Nondetect
B Concentration between the instrument detection limit and the contract reporting limit

Bold/shaded values are concentrations that exceed regulatory limits

As	Arsenic	Ba	Barium
Cd	Cadmium	Cr	Chromium
Pb	Lead	Hg	Mercury
Se	Selenium	Ag	Silver

TABLE 4-5

SMELTER WASTE ACIDITY AND LIME REQUIREMENTS
TOSTON SMELTER SITE

Sample Number	Matrix	Sample pH	Soil-Buffer pH	Acid pH	Acidity (meq/5g)	Liming Requirement (t/1000tons)[a]
SS-2	Soil, trace slag	7.03	7.26	6.51	+0.07	+1.56
SS-5	Speiss	6.17	7.56	6.21	+0.02	+0.82
SS-11	Sulfide	1.57	1.76	1.64	-9.63	-162.35
BP-12-2.5	Soil below slag/speiss	8.01	7.78	6.57	+0.08	+1.71
BP-18-2.5	Soil below sulfide	2.68	3.95	3.20	-0.91	-14.98

Notes:

meq/5g Milliequivalents per 5 grams of soil
t/1000t Tons lime to neutralize 1,000 tons of soil
a (+) indicates excess neutralization capacity; (-) indicates deficient neutralization capacity

Acid-Base Accounting

ABA is a more comprehensive method for measuring the acid generating potential of solid-matrix materials due primarily to the oxidation of iron disulfides. The ABA method balances the maximum potential acidity from immediately titratable sources, plus sulfuric acid equivalent calculated from total sulfur against total neutralizers such as alkaline carbonates, exchangeable bases, weatherable silicates, or other rock sources (Sobek and Others 1987). In this situation, calculating the acid-base potential (ABP) using total sulfur content will produce a conservative estimate of the acid potential for the materials. Positive ABP results indicate that there is more acid-neutralizing capacity in the smelter waste than there is acid-generating capacity. A negative ABP result indicates that the smelter waste has an acid-generating capacity. The ABP results are presented in Table 4-6.

ABA determinations have been performed on 13 solid-matrix samples. The total sulfur acid/base potential for sulfide waste or sulfide impacted soil ranged from -92.2 t/1,000t (sample BP-18-2.5) to -667.2 t/1,000t (sample SS-11). The acid generating potential for the samples of the sulfide waste is from sulfide sulfur with minor amounts of organic sulfur and sulfate sulfur. The acid generating potential for the samples of the soil impacted by sulfide waste is from equal parts of sulfide sulfur and sulfate sulfur.

Samples of the slag and speiss ranged from excess neutralization potential (sample 04-505-SL-2) to -102.5 t/1,000t (sample SS-5). The form of sulfur that contributed the most to the acid generating capacity varied between organic sulfur and sulfide sulfur. The background sample and sediment samples had excess neutralization potential.

Potential Repository and Borrow Soil Locations

Potential repository or borrow soil areas at the Toston Smelter site are located west of Big Springs Ditch south of the contaminated area. The potential borrow material is silty sand with low organic carbon and nutrient content. These materials were up to 4 feet thick at the southern end of the site but would likely require nutrient and organic material amendments prior to use as topsoil. The depth to groundwater in this potential repository area is 15 feet; thus the bottom of the repository should not be over 5 feet below the current site elevation. Below the silty sand are river gravels that would not be suitable as cover soil.

TABLE 4-6

ACID-BASE ACCOUNTING (ABA)
TOSTON SMELTER SITE

Sample ID	Matrix	Total % S	Hot Water % Sulfate S	HCl Extractable S % Insoluble Sulfide S	HNO_3 Extractable S % Sulfide S	Residual S % Organic S	NP t/1000t	TS-AB t/1000t	TS-ABP t/1000t[a]	Pyritic S-AB t/1000t	Pyritic S-ABP 1/1000t[a]
SS-2	Soil, trace slag	0.53	<0.01	0.03	0.38	0.12	26.3	16.56	9.7	12.58	13.7
SS-5	Speiss	3.28	0.24	1.75	0.92	0.37	<1.0	102.5	-102.5	69.65	-69.6
SS-11	Sulfide	21.35	1.90	<0.01	15.95	3.55	<1.0	667.19	-667.2	498.44	-498.4
BP-12-2.5	Soil below slag/speiss	<0.01	<0.01	<0.01	<0.01	<0.01	80.7	<0.01	80.7	<0.55	80.7
BP-18-2.5	Soil below sulfide	2.95	1.41	0.07	1.47	<0.01	<1.0	92.19	-92.2	47.49	-47.5
04-505-SL-1[b]	Slag	3.48	0.17	0.69	NA	1.57	66.9	108.8	-41.9	46.2	20.7
04-505-SL-2[b]	Slag	1.65	0.07	0.44	NA	0.94	440.4	51.6	388.8	18.5	421.8
04-505-SL-3[b]	Slag	1.18	0.71	0.20	NA	0.08	9.4	36.9	-27.5	10.8	-1.4
04-505-SE-1[b]	Sediment	<0.01	<0.01	<0.01	NA	<0.01	30.0	0.0	30.0	0.0	30.0
04-505-SE-2[b]	Sediment	<0.01	<0.01	0.02	NA	<0.01	55.6	0.0	55.6	0.0	55.6
04-505-WR-1[b]	Sulfide	12.2	1.1	8.14	NA	2.56	<1.0	381.3	-381.3	263.8	-263.8
04-505-TP-1[b]	Sulfide	5.03	2.46	2.22	NA	0.04	<1.0	157.2	-157.2	76.5	-76.5
04-505-BG-1[b]	Background soil	<0.01	<0.01	<0.01	NA	<0.01	21.9	0.0	21.9	0.0	21.9

Notes:

t/1000t	Ton per 1,000 tons	ABP	Acid or Base Potential
S	Sulfur	HCl	Hydrochloric acid
TS	Total sulfur	HNO_3	Nitric acid
NP	Neutralization potential	NA	Not available, may be combined with HCl extractable S

a (+) indicates excess neutralization capacity; (-) indicates deficient neutralization capacity
b Completed during the site assessment

Source: Hazardous Materials Inventory (Pioneer 1997)

5.0 SUMMARY OF SITE RISKS

Baseline human health and ecological risk assessments were conducted for the Toston Smelter site as part of the RI activities performed in September 1998. The risk assessments were conducted using current guidance set forth by: (1) "Risk-Based Cleanup Guidelines for Abandoned Mine Sites" (Tetra Tech 1996); (2) standardized risk assessment spreadsheets developed by MWCB; and (3) guidance established by EPA (1989a). The risk assessments have been updated in this EEE/CA to reflect refined land use areas and to include additional data gathered at the site. The human health risk assessment is presented in Section 5.1; the ecological risk assessment is presented in Section 5.2. Risk assessment data and calculation spreadsheets are in Appendix A.

5.1 HUMAN HEALTH RISK ASSESSMENT

A baseline human health risk assessment was conducted for the Toston Smelter site using current site land uses and contaminant concentrations measured during the RI conducted in September 1998. The assessment involved five steps: (1) hazard identification; (2) exposure assessment; (3) toxicity assessment; (4) risk characterization; and (5) calculation of risk-based cleanup goals. The following sections discuss these five steps in greater detail.

5.1.1 Hazard Identification

Hazard identification is conducted to identify the contaminants of concern (COC) for the site. Each COC must meet four criteria established by the EPA (1989a): (1) the constituent is present at the site; (2) the measured constituent concentrations are significantly above background concentrations; (3) 20 percent of the measured constituent concentrations must be above the method detection limit; and (4) the analytical results for each constituent must meet the quality assurance/quality control (QA/QC) criteria established for the data set.

During the Toston Smelter site RI, 26 solid matrix and 5 water samples were collected and analyzed at an off-site laboratory. These samples included 23 surface soil and smelter waste samples, three background soil samples, two surface water samples, and three groundwater samples. The analytes present at the site that met the limits of detection and QA/QC requirements were antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, nickel, silver, and zinc (see Appendix A). Antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver, and zinc were detected at concentrations at least three standard deviations above the mean background concentrations. No potential residential scenarios exist at the Toston Smelter site; therefore, metals concentrations were compared to the cleanup levels for the 50-day rockhound/goldpanner recreational scenario or the all-terrain vehicle (ATV)/motorcycle rider (MR) scenario (Tetra Tech 1996).

Surface water samples were collected from the Missouri River upstream and downstream of the Toston Smelter site. The samples were analyzed for antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, and zinc at an off-site laboratory. Metal concentrations in the downgradient sample were nearly identical to the concentrations found in the upgradient sample. There is no measurable impact from the site on the Missouri River. Therefore, the potential effects of surface water were not included in the risk assessment.

5.1.2 Exposure Assessment

The purpose of the exposure assessment is to identify the human receptors who may be exposed, the exposure routes through which the receptors may come into contact with hazardous constituents, and the assumptions and data used to quantify the exposure.

The main exposure scenario developed for the Toston Smelter site is for on-site recreation. Risks to recreational receptors at the site are included in the rockhound/goldpanner and ATV/MR exposure scenarios evaluated in the "Risk-Based Cleanup Guidelines for Abandoned Mine Sites" (Tetra Tech 1996). The potential for recreational use of the Toston Smelter site is high due to its location along the Missouri River, its relatively easy access, and proximity to the surrounding communities of Toston, Townsend, and Helena.

A total of eight (N=8) samples including sulfide waste (N=1) and smelter waste (N=7) were used to calculate exposure point concentrations for the human health exposure assessment. The sample used to evaluate risk from the sulfide waste was the only sample collected entirely from the sulfide waste. The samples used to calculate the smelter waste exposure point concentrations were selected because they contained a relatively high percentage of speiss or slag. The samples used to calculate exposure point concentrations are listed in Table 5-1 and the exposure point concentrations are listed in Table 5-2.

TABLE 5-1

SAMPLES USED TO CALCULATE EXPOSURE POINT CONCENTRATIONS TOSTON SMELTER SITE

Waste Source	Sample Numbers
Smelter Waste (N=7)	SS-1, SS-2, SS-3, SS-4, SS-5, SS-6, SS-13
Sulfide Waste (N=1)	SS-11

TABLE 5-2

EXPOSURE POINT CONCENTRATIONS (mg/kg) TOSTON SMELTER SITE

Waste Type	Sb	As	Cd	Cu	Fe	Pb	Mn	Hg	Ag	Zn
Smelter Waste (N=7)	70.1	573	5.9	340.4	34,000	23,800	500	0.2	55.5	1,370
Sulfide Waste (N=1)	18.4	29,600	44.2	12.6	320,000	649	20.5	0.035	21.9	18.8

Notes:

Sb	Antimony	As	Arsenic	Cu	Copper	Fe	Iron
Pb	Lead	Mn	Manganese	Hg	Mercury	Ag	Silver
Zn	Zinc						

mg/kg Milligrams per kilogram

5.1.3 Toxicity Assessment

The toxicity assessment phase evaluates the potential for COCs to cause adverse carcinogenic or noncarcinogenic effects in exposed populations. The most hazardous COCs identified at the Toston Smelter site are arsenic and lead. The following sections summarize the potential adverse effects and dose-response relationships for these metals. The other metals listed in Table 5-2 do not pose a significant risk to potential human receptors and were, therefore, excluded.

5.1.3.1 Arsenic

Arsenic is the twentieth most abundant element in the earth's crust and is present in virtually all living organisms. In certain areas of the United States and Canada, fresh water supplies contain up to 1.4 mg/L. Seafood can contain significant concentrations of arsenic ranging from 2 mg/kg for freshwater fish to 22 mg/kg for lobsters, most of which is organically (protein) bound. The average adult dietary intake of arsenic is between 0.025 and 0.033 milligrams per kilogram per day (mg/kg/d). This amount is nearly twice that considered by EPA to produce adverse health effects in humans (that is, lowest observed adverse effects level [LOAEL] = 0.17 mg/L or 0.014 mg/kg/d).

The largest source of human exposure to arsenic is arsenical pesticides which account for 80 percent of the industrial consumption of arsenic worldwide. However, other principal uses of arsenic include the manufacture of pharmaceuticals, glass and ceramic products, and in metallurgy.

Arsenic (and arsenic-compounds), especially organic arsenicals, are readily absorbed into the body following inhalation, ingestion, or dermal contact. When ingested, soluble arsenic compounds, including solutions, are almost completely absorbed through the gastrointestinal tract. Conversely, insoluble arsenic compounds are poorly absorbed, if at all. An orally administered dose of arsenic is distributed rapidly to virtually all tissue compartments (probably bound to protein), with the highest concentrations subsequently detected in the muscle, followed by liver, hair, nails, and kidney; excretion by the kidney is almost complete within 6 days and accounts for over 90 percent of the dose. In liver tissue, trivalent arsenic (As^{+3}) is converted by microsomal enzyme systems and excreted in urine as multiple metabolites including dimethylarsenic acid (50 percent), methyl arsenic acid (14 percent), pentavalent arsenic (8 percent), and trivalent arsenic (8 percent). Organo-arsenic compounds like those typically found in crab meat and other types of seafood are excreted essentially unchanged.

These "detoxification" processes effectively increase the molecular weight and polarity of the metal-complex, thereby enhancing the rate of excretion in aqueous urine (half-life [$t_{1/2}$] = 7 hours). Like lead, mercury, and other heavy metals, arsenic is readily incorporated in fingernails, toenails, bone, and hair, providing an additional means of assessing historic exposure.

Symptoms of acute arsenic exposure include vomiting and diarrhea due to severe gastrointestinal distress and general vascular collapse. The estimated lethal doses for humans are 60 milligrams of trivalent arsenic (As^{+3}) and 250 milligrams of pentavalent arsenic (As^{+5}). The most frequently noted and characteristic effects of chronic arsenic toxicity in humans include skin lesions, peripheral vascular disease, cardiovascular abnormalities, and peripheral neuropathy. However, the most significant toxic effect of chronic or prolonged low-level exposure to arsenic is carcinogenicity including increases in the incidence of respiratory and skin cancers. For example, repeated epidemiological studies have found an increased incidence of skin and respiratory tract tumors in those exposed to arsenic fumes and dusts. Some studies have also reported increased bladder cancers. One study of elderly males in villages with arsenic-tainted drinking water showed a dose and time-dependent response curve, with skin cancer rates as high as 26 percent in those exposed to water containing greater than 0.6 mg/L of arsenic. However, results of ingestion studies with animals have been generally equivocal.

Most reports of chronic arsenic toxicity have been in occupational settings from workers exposed to fumes and dusts, causing local irritation of the mucous membranes of the eyes and nose. This is best diagnosed by measurement of hair or urinary concentrations. For example, arsenic concentrations in hair of normal persons are typically less than 1 mg/kg (average 0.5), whereas concentrations in subjects of chronic poisoning are often between 1 and 5 mg/kg, and can range as high as 47 mg/kg.

Given its systemic distribution, arsenic is readily transported across the placenta to fetal tissues, but teratogenicity (birth defects) and other reproductive effects have not been reported in laboratory animals at low to moderate parental dosages. However, chromosomal aberrations have been documented in humans exposed to industrial sources of arsenic, and select arsenic compounds have been found to be mutagenic in both *in vivo* and *in vitro* studies.

Arsenic is a Class A (that is, known) human carcinogen. Its oral slope factor is listed in EPA's Integrated Risk Information System (IRIS) substance file (last updated 02/06/98), as 1.5 mg/kg/d. No dermal slope factor was available for arsenic at the time this report was written. However, a dermal slope factor of 20 times the oral slope factor has been derived and employed on the basis that 5 percent of an ingested dose is absorbed by the gastrointestinal tract (EPA 1989a). The oral reference dose (RfD) reported in IRIS (EPA 1995) for arsenic toxicity in humans is 0.0003 mg/kg/d based on a chronic exposure study which produced hyper-pigmentation, teratosis, and possible vascular complications. The confidence level reported for this oral RfD was "medium." Unfortunately, no direct RfD for arsenic is available for the inhalation or dermal exposure pathways. As above, a dermal RfD value equal to five percent of the oral RfD has been derived assuming that approximately five percent of the ingested arsenic will be absorbed by the gastrointestinal tract (EPA 1989a). No RfD was calculated for the inhalation pathway since there is no standard relationship between oral and inhalation RfDs for inorganic compounds (EPA 1989a). An uncertainty factor of three is deemed sufficient for the arsenic RfD to account for outlying groups or effects, including so-called "sensitive" individuals, potential reproductive impacts, and other toxicological data gaps.

5.1.3.2 Lead

Lead and inorganic lead compounds are found in a variety of commercial products and industrial materials, including paints, plastics, storage batteries, bearing alloys, insecticides, and ceramics. In addition, lead is found naturally occurring in western United States soil at an average concentration of about 17 mg/kg (Shacklette and Boerngen 1984).

Humans are in a state of positive lead balance from the day of birth, such that a relatively slow accumulation occurs until a total body burden of approximately 50 to 350 milligrams of lead exists by age 60. Normal adults have been shown to absorb approximately 5 percent of an oral dosage of various lead compounds, although absorption depends entirely on the individual and the nature of the lead compound in question. Research has shown that men typically have higher concentrations of lead in nearly all tissues than women, and further, that the developing fetus and adolescent children are the two most sensitive subpopulations.

Over 90 percent of absorbed lead is deposited in bone, primarily dense bone, with only minor amounts excreted in hair, nails, or urine. However, the average absorption of lead in children may be significantly higher than adults (that is, as high as 50 percent). Inhalation studies have shown that about half the lead deposited in the alveoli of the lung is absorbed directly into the blood stream, and that most of the dosage (90 to 95 percent) is subsequently deposited in skeletal bone where the half-life is estimated to be 7 to 10 years. Although the predominant elimination pathway for lead (and most heavy metals) is urine, the rate of urinary excretion is notably slow.

Lead has been shown to adversely affect many enzyme systems, but the overall health effects from lead exposure are typically related to elevated blood-lead concentrations which can result in a variety of toxicological effects, depending on the level of exposure. For example, the most noteworthy clinical indices of lead toxicity in humans are its effects on heme (blood) synthesis, resulting in erythrocyte anomalies, and imbalances of porphyrin, protoporphyrin, and aminolevulinic acid. Generally, a concentration of 40 micrograms per decaliter (μg/dL) is considered the normal upper-limit for blood lead, 99 percent of which is typically contained within erythrocytes.

The general symptoms of chronic lead poisoning include gastrointestinal disturbances, anemia, insomnia, weight loss, motor weakness, muscle paralysis, and nephropathy. For example, blood-lead concentrations of greater than 40 μg/dL have been associated with central nervous system and kidney damage, as well as pernicious anemia. Concentrations on this order have also been associated with reproductive effects, miscarriage in pregnant woman, and sterility in males. Blood concentrations of 30 μg/dL and higher have been associated with defects in Vitamin D metabolism and with learning deficits in exposed children.

The effects of lead exposure at blood concentrations of 20 μg/dL and lower are more difficult to define. Some studies have reported increased blood pressure in males, starting at blood concentrations of about 10 μg/dL. Low-level exposure to lead during early childhood can cause multiple effects including impaired intellectual and neurobehavioral development. In fact, it appears that some of these effects, particularly changes in the levels of certain blood enzymes and impaired neurobehavioral development of children, may occur at blood-lead levels so low as to be essentially without a "threshold." Similar low-level exposures to lead during pregnancy have been shown to cause reduced birth weight and preterm births. This sensitivity to lead toxicity extends from the fetal stage to the cessation of growth after puberty. Studies of blood-lead concentrations in children of industrially exposed fathers revealed that as many as 42 percent of the children had blood-lead concentrations greater than 30 μg/dL and over 10 percent of the children exceeded 80 μg/dL as a result of lead carried home on contaminated clothing.

On the basis of bioassay results in rats and mice, the EPA has classified lead as a Class B2 (that is, probable) human carcinogen. Controlled dosage studies in humans have produced renal tumors following dietary and subcutaneous exposures to soluble lead salts. However, dosages that typically induce cancer in humans are higher than those associated with other health effects of lead exposure such as reproductive and developmental toxicity and increased blood pressure.

Unfortunately, no standard carcinogenic slope factors or RfDs are available for lead. Although the "uptake biokinetic" model is used to calculate the risk to children in a *residential* land-use scenario, the model cannot be used to calculate risks to adults or children in *recreational* exposure settings. To determine the adult and child recreational risks from lead, a cancer slope factor or RfD must first be obtained or calculated. Using the uptake biokinetic model with standard residential assumptions, the maximum safe lead concentration for noncancerous effects has been determined to be 400 mg/kg. Therefore, to calculate oral and dermal RfDs, standard residential child exposure assumptions were combined with an exposure point concentration of 400 mg/kg. The RfD was then adjusted until the hazard quotient (HQ) was equal to 1.0. The dermal RfD was calculated to be 5 percent of the oral RfD assuming that approximately 5 percent of ingested lead is absorbed by the gastrointestinal tract (EPA 1989a). No RfD was calculated for inhalation since there is no standard relationship between inhalation and oral RfDs for inorganic compounds (EPA 1989a). Using the above derivation methods, the oral and dermal RfDs were determined to be 0.0026 and 0.00013 mg/kg/d, respectively.

5.1.4 Risk Characterization

Risk characterization is completed by using the exposure assumptions and toxicity assessment data to calculate the carcinogenic and noncarcinogenic risk for adults for a recreational exposure scenario. The following sections describe the risk calculations and uncertainty associated with the risk calculations.

5.1.4.1 Risk Calculations

The carcinogenic and noncarcinogenic risks to potential human receptors from antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver, and zinc in soil were calculated for the rockhound/goldpanner and ATV/MR recreational exposure scenarios. Tables summarizing the risk calculations are located in Appendix A. Individual HQ values and relative percent contributions to total risk for arsenic, iron, and lead are summarized in Table 5-3. The other metals were not included because their total HQs were less than 0.1. Table 5-4 lists the total carcinogenic (E-06) and noncarcinogenic hazard index (HI) risk values for the recreational exposure scenarios. The HI is the sum of the HQs for individual metals.

TABLE 5-3

RECREATIONAL SCENARIO
CONTAMINANT-SPECIFIC HQ VALUES FOR SOIL
TOSTON SMELTER SITE

Exposure Scenario	Metal Hazard Quotient for Soil			
	Arsenic	Iron	Lead	Total HQ
Rockhound/Goldpanner	91.6 (99.2)	0.32 (0.3)	0.295 (0.3)	92.3[a]
ATV/MR	1.00 (13.2)	0.03 (0.4)	6.08 (80.3)	7.57[b]

Notes:

a — The total HQ is 0.09 greater than the sum of As, Fe, and Pb due to the contribution of all the other metals.
b — The total HQ is 0.46 greater than the sum of As, Fe, and Pb due to the contribution of all the other metals.
() — Percent contribution to total HQ.
HQ — Hazard Quotient (relative toxicity value for a single metal in a single medium)
ATV/MR — All terrain vehicle/motorcycle rider

TABLE 5-4

RECREATIONAL SCENARIO CALCULATED RISKS
TOSTON SMELTER SITE

Exposure Senario	Risk	Total
Rockhound/ goldpanner	Carcinogenic (E-06)	2.13 E-02
	Noncarcinogenic (HI)	92.3
ATV/MR	Carcinogenic (E-06)	2.64 E-04
	Noncarcinogenic (HI)	7.57

Notes:

E-06: Per million subjects exposed.
HI: Hazard Index (the sum of Hazard Quotients HQ for all metals).
ATV/MR: All terrain vehicle/motorcycle rider

EPA uses a carcinogenic risk of 1.0E-06 and an HI of 1.0 as the threshold levels for assessing the need for contaminant cleanup. As can be seen in Table 5-4, risk calculations for the rockhound/goldpanner recreational exposure scenario resulted in carcinogenic risk and HI values well-above the threshold levels (that is, risk = 2.13 E-02 and HI = 92.3, respectively). For the ATV/MR exposure scenario the carcinogenic risk and HI values were above the threshold levels (that is, risk = 2.64 E-04 and HI = 7.57, respectively). Soil accounted for all the total carcinogenic and noncarcinogenic risk for both the rockhound/goldpanner and ATV/MR exposure scenarios.

As can be seen in Table 5-3, for the rockhound/goldpanner exposure scenario arsenic accounted for 99.2 percent of the total noncarcinogenic risk followed by lead and iron with 0.3 percent. For the ATV/MR exposure scenario lead accounted for 80.3 percent of the total noncarcinogenic risk followed by arsenic with 13.2 percent and iron with 0.4 percent. Arsenic accounted for all of the carcinogenic risk present at the site in both exposure scenarios.

5.1.4.2 Uncertainties in the Risk Calculations

Uncertainty in the calculated risk values can be created by a number of factors including: (1) exclusion of exposure pathways from the risk calculation, (2) inaccurate land use and exposure values, (3) accuracy of the toxicity values, (4) accuracy of the exposure point concentrations, and (5) exclusion of potentially hazardous constituents. Table 5-5 lists the relative effect that each of these sources of error may have on the calculated risk values.

(1) The exclusion of exposure pathways from risk calculations due to data gaps or the lack of applicable toxicity values will cause an underestimation of potential risk. The total site risk is the sum of the individual risks posed by each pathway (for example, soil, tailings, surface water).

(2) The exclusion of potentially hazardous constituents due to unreliable field data will result in the underestimation of risk. The total site risk is the sum of all risks from potentially hazardous constituents present in all media. The exclusion of contaminants from the risk calculations due to inferior data quality results in reduction of the calculated risk value(s). Potentially hazardous constituents detected at the site but not subjected to risk calculations include antimony and cadmium. The amount of underestimation regarding risk posed by these metals is unknown, but is probably less than one order of magnitude.

TABLE 5-5

SUMMARY OF UNCERTAINTIES FOR RISK ASSESSMENT
TOSTON SMELTER SITE

Source of Uncertainty	Probable Effect
Exclusion of exposure pathways from the risk calculation	Underestimate <1 OM
Exclusion of potentially hazardous constituents	Underestimate <1 OM
Inaccurate land use and exposure values	Overestimate up to 1 OM
Accuracy of the toxicity values	Overestimate up to 1 OM
Accuracy of the exposure point concentrations	Over or underestimate << 1 OM

Notes:

OM Order of Magnitude

(3) Conservative estimations surrounding land use and exposure assumptions will result in an overestimation of site risks. The land use assumptions were based on a visual inspection of the site. All areas with the potential for recreational use by humans were included in the recreational risk area. The exposure assumptions used in the risk assessment are standard values thought to be conservative. The amount of overestimation of risk due to these assumptions is unknown, but is not likely to exceed one order of magnitude.

(4) The magnitude of toxicity values strongly affects the calculated risk value. However, the reference toxicity values used in the current risk assessment were conservative in nature, likely resulting in an overestimation of site risk. The methodology used to develop reference toxicity values assures that the value will overestimate rather than underestimate the potential risk. The toxicity values calculated during this risk assessment are also likely to be conservative since they are derived from conservative starting points using conservative assumptions. The amount of overestimation from the use of toxicity values is unknown, but should not exceed one order of magnitude.

(5) The accuracy of calculated exposure point concentrations is unknown. However, the calculated exposure point concentrations used in this risk assessment are likely to result in an underestimation of site risk. Since a mean or average soil metal concentration was used in the risk assessment there are many areas with above-average concentrations of metals. Thus, the risk to a receptor exposed to areas with higher metal concentrations would be underestimated. Depending on the metal in question, the risk posed may be greater or lesser than that estimated by the risk assessment.

5.1.5 Risk-Based Cleanup Goals

Risk-based cleanup goals are calculated to allow the design and implementation of reclamation activities. Table 5-4 shows the carcinogenic and noncarcinogenic risks for the recreational exposure scenario at the Toston Smelter. Table 5-6 lists the soil cleanup goals (by individual analyte) for carcinogenic and noncarcinogenic risks posed in a recreational land use scenario.

TABLE 5-6

RECREATIONAL RISK-BASED CLEANUP GOALS
TOSTON SMELTER SITE

Maximum Recreational Use Value (10) (50-Day Rockhound/Goldpanner Scenario)		
Metal	**Soil (mg/kg)**	**Water (µg/L)**
Arsenic	323[a]	153[b]
Lead	2,200	220

[a] The soil noncarcinogenic cleanup guideline is 323 mg/kg. The soil carcinogenic cleanup guideline is 139 mg/kg.

[b] The water noncarcinogenic cleanup guideline is 153 mg/L. The water carcinogenic cleanup guideline is 66.2 mg/L.

5.1.6 Risk Characterization Summary

The risk values summarized for the Toston Smelter site in Tables 5-3 and 5-4 indicate that the site poses a high potential risk to recreational users of the area. The calculated HIs can be used to determine whether human receptors are potentially exposed to harmful doses of site-related contaminants via the high-use recreational scenarios evaluated.

The HQs calculated for individual metals (Table 5-3) indicate that for the rockhound/goldpanner exposure scenario arsenic poses almost all the risk. For the ATV/MR exposure scenario, lead poses the greatest potential risk followed by arsenic. The carcinogenic risks calculated for the rockhound/goldpanner and the ATV/MR exposure scenarios are greater than the threshold level of 1.0E-06 for assessing the need for contaminant cleanup. These HQs, carcinogenic risks, and various qualitative observations demonstrate that contaminants at the site constitute probable adverse human health effects for the recreational land use scenario. Consequently, appropriate clean-up measures for the site are warranted.

5.2 ECOLOGICAL RISK ASSESSMENT

A baseline ecological risk assessment was conducted for the Toston Smelter site using terrestrial plant communities and terrestrial wildlife, as well as contaminant concentrations measured during the RI conducted in September 1998. The assessment involved the initial identification of COCs followed by the development of an exposure assessment, an ecological effects assessment, and a risk characterization.

The ecological risk assessment was performed for the Toston Smelter site using several key federal guidance documents including: (1) EPA's "Risk Assessment Guidance for Superfund: Volume II - Environmental Evaluation Manual" (EPA 1989b); (2) EPA's "Framework for Ecological Risk Assessment" (EPA 1992); (3) EPA's "Wildlife Exposure Factors Handbook" (EPA 1993); and (4) "EPA's Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessment" (EPA 1994). The mining waste materials present at the site may pose a potential risk not only to humans but also to plants and animals that come into contact with them. Ecological risk assessments exclude the potential for effects on people and domesticated species, such as livestock. However, the health of people and domesticated species is inextricably linked to the quality of the environment shared with other species. The ecological evaluation which follows is intended as a qualitative screening-level ecological risk assessment (SLERA) because of the limited and indirect nature of the data available for the site.

The SLERA estimates the effects of taking no action at the site and involves four steps: (1) identification of contaminants, ecological receptors, and ecological effects of concern; (2) exposure assessment; (3) ecological effects assessment; and (4) risk characterization. These four tasks are accomplished by evaluating available data and selecting contaminants, species, and exposure routes of concern, estimating exposure point concentrations and intakes, assessing ecological toxicity of the COCs, and characterizing overall risk by integrating the results of the toxicity and exposure assessments.

Environmental contaminants at the Toston Smelter site that could impact ecological receptors include high concentrations of metals in speiss, slag, and sulfide waste. The vegetative communities on site have been affected by metal toxicity as evidenced by the apparent lack of vegetation in some areas. The smelter waste materials and vegetation in the area are easily accessible to wildlife and could result in significant ecological effects. The objective of this SLERA is to estimate current and future effects of implementing the no-action alternative at the Toston Smelter site.

5.2.1 Contaminants and Receptors of Concern

The purpose of this SLERA was to determine the potential for contact between ecological receptors and the COCs. The qualitative results of the SLERA may be used to determine the need for and the extent of the reclamation efforts. In addition, the SLERA is useful in identifying the exposure pathways and biological characterization of the site which are important for the human health risk assessment.

5.2.1.1 Contaminants of Concern

To be considered a COC, the metal must be detected at the site, have data that meet QA/QC criteria, and be present at concentrations above background. For soil, the analytes that meet these requirements are antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver, and zinc. For water, no metals were detected in the sample collected from the Missouri River downstream of the site at concentrations significantly above the concentrations measured in the sample collected upstream of the site.

Data tables in Section 4.0 summarize the detectable concentrations for metals in soils, smelter waste and sulfide waste. These COCs are characteristic of hard rock smelting wastes and should reliably represent contamination associated with smelting activities at the Toston Smelter site. However, several of these contaminants have no ecological toxicity data to evaluate potential effects. The following toxicological data pertain to arsenic, copper, lead, and zinc, the primary COCs identified in the SLERA.

Arsenic

Although arsenic is an essential nutrient and occurs naturally in the environment and in all organisms, it is also a teratogen and a "known" carcinogen that can traverse placental barriers and produce fetal death and malformations in many species of mammals (Eisler 1988a). Its bioavailability and toxicity are modified by many biotic and abiotic factors that include the physical and chemical forms of arsenic, the route of exposure, the dosage, and the species of affected organism. In general, inorganic arsenic compounds are more toxic than organic arsenic compounds (that is, arsenicals), and trivalent species are more toxic than pentavalent species. Arsenic has been demonstrated to bioconcentrate, but not biomagnify in certain organisms (Eisler 1988a).

Terrestrial plants accumulate arsenic by root uptake from the soil and by adsorption of airborne arsenic deposited on the leaves. Studies have shown that certain plant species can accumulate substantial levels (Agency for Toxic Substances and Disease Registry [ATSDR] 1993a). The effects of arsenic on mammals varies by species, exposure route or pathway, and the physical and chemical form of the arsenic. Many mammals can rapidly excrete ingested inorganic arsenic (Eisler 1988a). However, arsenic is distributed to most tissue compartments, including placental and fetal tissues.

Copper

Copper forms several common minerals in soils, of which the primary minerals are simple and complex sulfides. These sulfide minerals are easily solubilized during the soil weathering processes, during which copper ions are released and commonly accumulate in the upper soil horizons. Copper is one of the more mobile "heavy metals," especially in acidic soil environments. Once absorbed into plant tissues, copper appears to be far less mobile. Copper is considered the most toxic common heavy metal to aquatic organisms. This toxicity is inversely related to the hardness of the water; the harder the water, the less toxic copper is to aquatic organisms. Studies indicate that copper is also highly toxic to plants and will cause chlorosis and root malformation (Kabata-Pendias and Pendias 1989). Some plants (such as *Agrostis tenuis* and *Deschampsia caespitosa*) have been shown to evolve tolerance to elevated levels of copper in soils. Continued ingestion of copper by animals can lead to tissue accumulation, particularly in the liver (Underwood 1971).

Lead

Lead has been known to be a common pollutant and a potent environmental poison capable of altering normal blood formation and nervous system functions of the human body (Eisler 1988b). When absorbed in excessive amounts, lead can have carcinogenic properties, impair reproduction, liver and thyroid function, and interfere with resistance to infectious disease (EPA 1984). Lead is toxic in most of its chemical forms and can be incorporated into the body via inhalation, ingestion, dermal absorption, and placental transfer. Lead is also a known mutagen and teratogen.

The fate of lead in soil and soil solutions is affected by a variety of factors including precipitation of sparingly soluble forms of lead; the formation of relatively stable organic-metal complexes or chelates with soil organic matter; the soil's pH, CEC, and organic matter content; and the amount of lead present in the soil (ATSDR 1993b). Most forms of lead are retained rather strongly in soil and thus very little tends to leach from the soil. Lead can be transported via erosion of lead-containing soil particulates which can then be deposited in surface waters (ATSDR 1993b). Lead is not an essential element for plants and excessive amounts have been shown to inhibit growth (Eisler 1988b). The effects of lead on mammals can include growth retardation, delays in maturation, and reduced body weight.

Zinc

Zinc is found in fairly uniform concentrations in rocks and soils and may range from about 10 ppm to 120 ppm (Kabata-Pendias and Pendias 1989). Zinc is considered an essential nutrient for both plants and animals. Soluble forms of zinc are easily taken up by plants, particularly by the root systems. During soil weathering processes, zinc will commonly accumulate in the upper soil horizons. Zinc is not considered to be highly phytotoxic, but zinc toxicity is more prevalent in acidic soils. Several plant species and genotypes are known to have evolved a degree of tolerance to elevated levels of zinc in soils and some species may accumulate large amounts of the metal without showing overt symptoms of toxicity. Chlorosis (seen mainly in newly developed leaves) and depressed plant growth are the common symptoms of zinc toxicity (Kabata-Pendias and Pendias 1989).

5.2.1.2 Ecological Receptors of Concern

A variety of raptors, reptiles, and small mammals are part of the general food web for the Toston Smelter site, and many more species could be included in a more extensive ecological assessment. This SLERA has identified two groups of ecological receptors that are potentially affected by chemical contamination at the Toston Smelter site. The first group of potential receptors is the terrestrial plant communities, which are noticeably absent on much of the slag, speiss, and sulfide waste areas. Plant communities are of concern because they comprise the first trophic level within the food chain and are consumed by many higher trophic level animals.

The second and final group of potential ecological receptors is the terrestrial wildlife that may use the area as part of their home range, including mule deer and whitetail deer. Evidence of mule and whitetail deer were observed by TtEMI personnel on the smelter site during the RI field investigation. Grazing by wildlife species at this site is of concern due to the potential for consumption of contaminated vegetation, soil, and evaporative salts. The only terrestrial wildlife receptors evaluated in a quantitative manner in this ecological risk assessment are deer. Deer are assumed to represent the highest level of exposure to site contaminants and the effects to deer can apply to other potential receptors.

5.2.1.3 Ecological Effects of Concern

One observed ecological effect is that some areas (sources) on site are essentially devoid of vegetation. The lack of vegetation in these areas may be partially due to toxic and inhibitory levels of metals in the plant root zone along with other detrimental soil physical and chemical (infertility) properties. A second ecological effect of concern is the potential for deer and other wildlife to ingest contaminated vegetation, water, and evaporative salts that may form on the smelter and sulfide waste.

5.2.2 Exposure Assessment

Seven smelter waste samples were used to calculate exposure point concentrations for the SLERA. The specific samples used to calculate exposure point concentrations are listed in Table 5-1. Exposure point concentrations used for this SLERA (see Table 5-2) were from soil samples with the most "uniformly high" concentrations of metals detected at the Toston Smelter site.

The two exposure scenarios discussed below were used to assess ecological risk. However, the only scenario involving the calculation of a dosage was the one in which deer ingest contaminated soil, water, or salt. Contaminant criteria and toxicological indices used to assess both contamination and risk for the exposure scenarios were compiled from the following primary documents:

- Terrestrial plant communities: Gough and others 1979; Shacklette and Boerngen 1984; Kabata-Pendias and Pendias 1989; CH2M Hill 1987
- Terrestrial wildlife: Eisler 1988a and b; ATSDR 1993a and b; EPA 1993; Beyer and others 1994

5.2.2.1 Plant - Phytotoxicity Scenario

This scenario involves the limited ability of various plant species to grow in soils or smelter wastes with high concentrations of arsenic, copper, lead, and zinc. Plant sensitivities to certain arsenic compounds is so great that these compounds found use as herbicides for many years. Phytotoxic criteria reported in the literature for total arsenic in soils ranged from 15 to 50 mg/kg; the 50 mg/kg hazard level was considered an appropriate level for the Helena Valley, Montana (CH2M Hill 1987). Lead is also considered very toxic to plants. Numerous phytotoxic concentrations are reported in the literature and generally range from 100 mg/kg (Kabata-Pendias and Pendias 1989) to 1,000 mg/kg (John and Van Laerhoven 1972, CH2M Hill 1987). Zinc is only moderately toxic to plants at concentrations over 300 mg/kg (Kabata-

Pendias and Pendias 1989). A tolerable zinc concentration of 200 mg/kg in soil has been previously cited for the Helena Valley (CH2M Hill 1987).

5.2.2.2 Deer Ingestion Scenario

Estimates of total intake dosage for deer are based on reported literature values and the following assumptions: (1) the currently unvegetated areas do not provide deer habitat; (2) native vegetation is growing across most areas of the smelter site and would be available to deer grazing in the area; and (3) the average weight of an individual adult deer is 68.04 kilograms (150 pounds).

Contaminated Soil and Salt Intake

The daily salt uptake for deer is based on data in "Elk of North America" (U.S. Department of Agriculture [USDA] 1995) which reported a range of 1 to 11 pounds (average 6 pounds) in one month for a herd of 50 to 75 elk (average 63 head). Assuming deer require 50 percent of the elk salt volume, a median exposure (non-conservative) approach would equate to an average salt use of 3 pounds per month. Using the average herd size of 63, the average individual salt uptake would equal 0.0016 pounds per day (lbs/day), or 0.00072 kilograms per day (kg/day). Beyer and others (1994) estimated that soil ingestion accounts for less than 2 percent of the average Wyoming mule deer's diet of 1.39 kg/day of vegetation. This would equal 0.0278 kg/day of soil. The arithmetic average metal concentrations for the surface soils across the smelter site were used for both the salt and soil levels since these were the highest values calculated.

Metals in Vegetation Intake

Beyer and others (1994) estimated that an average mule deer ingests 1.39 kg of vegetation per day in summer. No vegetation samples were collected for analysis during the RI. The concentrations of arsenic (50 parts per million [ppm]), lead (25 ppm), and zinc (50 ppm) used in this calculation were the tolerable levels in vegetation (lowest phytotoxic tissue levels) from the East Helena assessment (CH2M Hill 1987). The concentration for copper (15 ppm) was estimated based on data obtained from Kabata-Pendias and Pendias (1989). The metal-contaminated areas at the Toston Smelter site cover approximately 10 acres. This area would represent approximately 2.9 percent of an estimated average mule deer's home range of 90 to 600 acres (average of 345 acres; Beyer and others 1994).

5.2.3 Ecological Effects Assessment

The effects of the COCs at this site are available from several literature sources and are not repeated here. No site-specific toxicity tests were performed to support this SLERA. Only existing and proposed toxicity-based criteria and standards were used for this SLERA. The following sections detail the specific standards and data that were used for comparison to the analytical results of the RI field sampling investigation.

5.2.3.1 Plant - Phytotoxicity Scenario

A summary of the phytotoxicity for selected metals of concern (Kabata-Pendias and Pendias 1989) is provided in Table 5-7. These concentrations were used for comparison to mean slag, speiss, and sulfide waste metal concentrations. The availability of contaminants to plants and the potential for plant toxicity depends on many factors including soil pH, soil texture, nutrients, and plant species.

TABLE 5-7
SUMMARY OF TOLERABLE AND PHYTOTOXIC SOIL CONCENTRATIONS (mg/kg dry weight)
TOSTON SMELTER SITE

Element	Tolerable Soil Level (CH2M Hill 1987)	Phytotoxic Soil Concentrations (Kabata-Pendias and Pendias 1989)
Arsenic	50	15 to 50
Copper	Not determined	60 to 125
Lead	25	100 to 400
Zinc	50	70 to 400

5.2.3.2 Deer Ingestion Scenario

Adverse effects data for test animals were obtained from the ATSDR toxicological profiles (1993a; 1993b), and from other literature sources (Eisler 1988a; 1988b). The data consist of dose (intake) levels that either cause no observed adverse effects (NOAEL) or the lowest dose observed to cause an adverse effect (LOAEL) in laboratory animals. The use of effects data for other species introduces an uncertainty factor to the assessment; however, effects data for all metals are not available for the species of concern (deer). The lethal arsenic dose of 34 (mg/kg/d) for deer (Eisler 1988a) is also included. Data for laboratory animals (primarily rats) have been adjusted only for increased body weight. These data are listed in Table 5-8.

TABLE 5-8

MAMMALIAN TOXICOLOGICAL DATA FOR INORGANIC METALS
TOSTON SMELTER SITE

Dose (mg/kg/d)	Arsenic	Copper	Lead	Zinc
NOAEL[a] - Rat	3.2	22.5	0.05	55
LOAEL[b] - Rat	6.4	90	5	571
References	ATSDR 1993a	NAS 1980	ATSDR 1993b; Eisler 1988b	Maita and Others 1981
Lethal - Deer	34	NA	NA	NA
Reference:	Eisler 1988a	NA	NA	NA

Notes:

a No Observed Adverse Effect Level (NOAEL)
b Lowest Observed Adverse Effect Level (LOAEL)
NA Not Available
NAS National Academy of Sciences

5.2.4 Risk Characterization

This section combines the ecological exposure estimates and concentrations presented in Section 5.2.2 and the ecological effects data presented in Section 5.2.3 to provide a screening level estimate of potential adverse ecological impacts for the two scenarios evaluated. This was accomplished by generating "ecological impact quotients" (EQ) analogous to the HQs calculated for human exposures to non-carcinogens. EQs were calculated for each contaminant of concern by exposure scenario or receptor-type and are summarized in Table 5-9. Contaminant-specific EQs were generated by dividing the particular intake estimate or concentration by available ecological effect values or concentrations. Tables summarizing the risk calculations are found in Appendix A. As with HIs, if EQs are less than one, adverse ecological impacts are not expected at the Toston Smelter site.

TABLE 5-9

ECOLOGICAL IMPACT QUOTIENTS
TOSTON SMELTER SITE

Receptor	Arsenic	Copper	Lead	Zinc	Total EQ By Receptor
Plant Phytotoxicity	11.5 (14.8)	2.72 (3.5)	59.5 (76.4)	3.43 (4.4)	77.8 (100)
Deer Ingestion	<0.01 (NA)	<0.01 (NA)	75.7 (99.9)	<0.01 (NA)	75.7 (100)
TOTAL EQ BY COC	11.5 (7.5)	2.72 (1.8)	135 (87.7)	3.43 (2.2)	154 (100)

Notes:

( )	Percent contribution to total receptor EQ.
EQ	Ecological Impact Quotient (relative toxicity value for a single metal in a single medium)
NA	Not Applicable
COC	Contaminant of Concern
<	Less than

5.2.4.1 Plant - Phytotoxicity Scenario

Average concentrations collected from the source area at the Toston Smelter site were compared to high values of the range of plant phytotoxicity derived from the literature. One limitation of this comparison is that the phytotoxicity ranges are not species-specific; they represent toxicity to species which may or may not be present at the Toston Smelter site. Additionally, other physical characteristics of the waste materials may create micro-environments which limit growth and survival of terrestrial plants directly or in combination with substrate toxicity.

Smelter waste materials are likely to have elevated metals concentrations, low organic content, limited nutrients, and may harden enough to resist root penetration. The results of the EQ calculations for this scenario are presented in Table 5-9. The calculated EQs for plant phytotoxicity at the Toston Smelter site were greater than 1.0 for arsenic, copper, lead, and zinc. The non-conservative assumption of using the high-end of the phytotoxicity range to derive the EQs may underestimate the potential phytotoxic effect to some plant communities. However, several other factors in addition to phytotoxicity combine to adversely affect plant establishment and successful reestablishment on waste materials. In addition, the arithmetic mean for metal concentrations in soil was used as the plant dosage value in the EQ calculation, presenting the likelihood of an overly conservative EQ.

5.2.4.2 Deer Ingestion Scenario

Estimated deer ingestion doses were compared to the higher of the literature-derived toxicological effect levels (that is, LOAEL). The contaminant-specific EQs were generated by dividing the total intake estimates by the toxicological effect values. Again, the comparison is limited because of the use of effects data for other species (rat) that were adjusted only for increased body weight. The species used in the toxicological studies may have been more or less susceptible to the contaminant in question than deer. The results of the EQ calculations for this scenario are also presented in Table 5-9.

The calculated EQs for the deer ingestion scenario exceeded 1.0 for lead only. This indicates a potential risk to deer and other wildlife as a result of lead concentrations in surface soils.

The assumptions used to derive the uptake dose and the comparison to rat toxicity may incorrectly estimate the actual average contaminant intake for deer. This potential for an adverse effect can be extended to other wildlife that may also use the area for a food and salt source.

5.2.4.3 Risk Characterization Summary

The calculated EQs can be used to determine whether ecological receptors are potentially exposed to harmful dosages of site-related contaminants via the two ecological scenarios evaluated. The EQs calculated for the Toston Smelter site indicate that lead is the greatest overall risk driver for the site with an EQ_{Pb} of 135. The risk posed by lead is split between plant toxicity (EQ = 59.5) and deer ingestion (EQ = 75.7). Lead (EQ = 75.7) poses virtually all (99.9 percent) of the risk to deer. Arsenic also poses a significant risk with an EQ_{As} of 11.5. Most of the risk from arsenic is for plant toxicity. Copper and zinc pose a lesser risk with EQs of 2.72 and 3.42, respectively. The risks from copper and zinc are for plant toxicity.

Collectively, these calculated EQs and qualitative observations demonstrate that contaminants at the site constitute probable adverse ecological effects for plants and deer at the Toston Smelter site justifying appropriate cleanup measures.

6.0 SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Reclamation activities at the Toston Smelter site will incorporate federal and state cleanup requirements. The standards, requirements, criteria, or limitations that will be used to conduct reclamation activities for this site are commonly referred to as applicable or relevant and appropriate requirements (ARAR).

Two basic types of reclamation activities for abandoned mine sites are (1) on-site or off-site disposal (removal) with subsequent revegetation, and (2) in-place amelioration (reclamation) with subsequent revegetation. Removal activities are designed to eliminate a source of waste from a site and are often conducted to alleviate the most acute or toxic contaminated materials. Amelioration activities are designed to minimize, stabilize, or mitigate the contaminated materials to ensure a high level of contaminant reduction and to achieve successful reclamation at a site.

ARARs may be either "applicable" or "relevant and appropriate" to reclamation activities at a site, but not both. Applicable requirements are those standards, requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address hazardous substances, pollutants, contaminants, activities, locations, or other circumstances found at the site. The reclamation activities should satisfy all the jurisdictional prerequisites of a requirement for them to be applicable to the specific activity at a site.

Relevant and appropriate requirements are those standards, requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to hazardous substances, pollutants, contaminants, activities, locations, or other circumstances at a site, address problems or situations sufficiently similar to those encountered at a site that their use is well suited to a particular site. Factors which may be considered in making this determination, when the factors are pertinent, are presented in 40 CFR 300.400(g)(2). They include, among other considerations, examination of the purpose of the requirement and of the proposed activity, the medium and substances regulated by the requirement, the regulated actions or activities, and the potential use of resources affected by the requirement.

ARARs are divided into contaminant-specific, location-specific, and action-specific requirements. Contaminant-specific requirements govern the release of materials possessing certain chemical or physical characteristics or containing specific chemical compounds to the environment. Contaminant-specific ARARs generally set human or environmental risk-based criteria and protocol which, when applied to site-specific conditions, result in the establishment of numerical action values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment.

Location-specific ARARs relate to the geographic or physical position of the site, rather than to the nature of site contaminants. These ARARs place restrictions on the concentration of hazardous substances or the conduct of cleanup activities due to their location in the environment.

Action-specific ARARs are usually technology- or activity-based requirements or are limitations on actions taken with respect to hazardous substances. A particular activity will trigger an action-specific ARAR. Unlike chemical-specific and location-specific ARARs, action-specific ARARs do not, in themselves, determine the reclamation alternative. Rather, action-specific ARARs indicate how the selected reclamation activity should be completed.

Nonpromulgated advisories or guidance documents issued by federal or state governments do not have the status of potential ARARs. However, these advisories and guidance are "to be considered" (TBC) when determining protective cleanup levels, as defined in 40 CFR 300.400 (g)(3). The TBC category consists of advisories, criteria, or guidance that were developed by the EPA, other federal agencies, or states that may be useful in developing reclamation alternatives.

Only those state standards that are more stringent than any federal standard and that have been identified by the state are appropriately included as ARARs. Duplicative or less stringent standards will be deleted as appropriate when the final determination of ARARs is presented.

ARARs are defined as only federal environmental laws and state environmental or facility siting laws. The reclamation activities and operation and maintenance must, nevertheless, comply with all other applicable laws, both state and federal. Many such laws, while not strictly environmental or facility siting laws, have environmental impacts. Moreover, applicable laws that are not ARARs because they are not environmental or facility siting laws, are not subject to the ARAR waiver provisions; the applicable provisions of such laws must be observed. A separate list attached to the state ARARs list is a noncomprehensive identification of other state law requirements which must be observed during reclamation activities, operation, and maintenance.

Table 6-1 presents the potential federal ARARs for the Toston Smelter site. Potential state ARARs are presented in Table 6-2. Appendices A and B provide more complete detailed descriptions of potential federal and state ARARs, respectively, and their applicability to the Toston Smelter site. Tables 6-1 and 6-2 summarize of the federal and state ARARs descriptions with paraphrased legal requirements, as well as an appendix reference page. In the event of any inconsistency between the law itself and the summaries in this section, the ARAR is ultimately the requirement as set out in the law, rather than the paraphrased requirement provided in Tables 6-1 or 6-2 of this document.

TABLE 6-1
SUMMARY OF FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
TOSTON SMELTER SITE

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable Relevant and Appropriate	Appendix Page Reference
Contaminant-Specific				
Clean Air Act	42 USC § 7409			
National Primary and Secondary Ambient Air Quality Standards	40 CFR Part 50	Air quality levels that protect public health.	Applicable	B-1
Resource Conservation and Recovery Act				
Lists of Hazardous Wastes	40 CFR Parts 261, Subpart D	Defines those solid mining-related wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 262-265 and Parts 124, 270, and 271.	Applicable	B-2
Clean Water Act	33 USC § 1251-1387	Chapter 26-Water Pollution Prevention and Control.		B-2
Water Quality Standards	40 CFR Part 131 Quality Criteria for Water 1976, 1980, 1986	Sets criteria for water quality based on toxicity to aquatic organisms and human health.	Relevant and Appropriate	B-2
National Pollutant Discharge Elimination System (NPDES)	40 CFR Part 122	General permits for discharge from construction.	Relevant and Appropriate	B-2
Safe Drinking Water Act	40 USC § 300			B-2
National Primary Drinking Water Regulations	40 CFR Part 141	Establishes health-based standards for public water systems (maximum contaminant levels).	Relevant and Appropriate	B-2
National Secondary Drinking Water Regulations	40 CFR Part 143	Establishes welfare-based standards for public water systems (secondary maximum contaminant levels).	Relevant and Appropriate	B-2
Location-Specific				
National Historic Preservation Act	16 USC § 470; 36 CFR Part 800 40 CFR 6.310(b)	Requires federal agencies to take into account the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object that is included in, or eligible for, inclusion in the National Register of Historic Places. To minimize harm to any national historic landmark adversely or directly affected by an undertaking.	Applicable	B-3

TABLE 6-1 (Continued)
SUMMARY OF FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
TOSTON SMELTER SITE

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable Relevant and Appropriate	Appendix Page Reference
Archeological and Historic Preservation Act	16 USC § 469; 40 CFR § 6.301(c)	Establishes procedures to provide for preservation of historical and archeological data which might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.	Applicable	B-4
Historic Sites, Buildings, and Antiquities Act	16 USC §§ 461 through 467; 40 CFR § 6.301(a)	Requires federal agencies to consider the existence and location of landmarks on the National Registry of Natural Landmarks to avoid undesirable impacts on such landmarks.	Applicable	B-4
Protection of Wetlands Order	40 CFR Part 6	Avoid adverse impacts to wetlands.	Applicable	B-4
Endangered Species Act	16 USC §§ 1531(h) through 1543; 40 CFR Part 6.302; 50 CFR Part 402	Requires action to conserve endangered species within critical habitat upon which species depend. Activity may not jeopardize continued existence of endangered species or destroy or adversely modify a critical habitat. Includes consultation with the Department of the Interior.	Applicable	B-5
Resource Conservation and Recovery Act	40 CFR Part 264	Require hazardous waste facilities to be (1) located at least 200 feet from a fault, and (2) designed to withstand a 100-year flood if located in the 100-year flood plain.	Applicable	B-5
Action-Specific				
Hazardous Materials Transportation Act	49 USC §§ 1801-1813			B-6
Standards Applicable to Transport of Hazardous Materials	49 CFR Parts 10, 171 through 177	Regulates transportation of hazardous materials including mining wastes that are not exempt under the Bevill Amendment.	Applicable	B-5

TABLE 6-1 (Continued)
SUMMARY OF FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
TOSTON SMELTER SITE

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable Relevant and Appropriate	Appendix Page Reference
Resource Conservation and Recovery Act				
Criteria for Classification of Solid Waste Disposal Facilities and Practices	40 CFR Part 257	Establishes criteria for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health or the environment and, thereby, constitute prohibited open dumps.	Applicable	B-6
Standards Applicable to Transporters of Hazardous Waste	40 CFR Part 263	Establishes standards which apply to persons transporting hazardous waste within the United States if the transportation requires a manifest under 40 CFR Part 262.	Applicable	B-7
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	40 CFR Part 264	Establishes minimum national standards which define the acceptable management of hazardous waste for owners and operators of facilities which treat, store, or dispose of hazardous waste.	Applicable	B-6
Clean Water Act	33 USC § 1342			B-8
National Pollutant Discharge Elimination System	40 CFR Part 122	Requires permits for the discharge of pollutants from any point source into waters of the United States (Big Creek).	Relevant and Appropriate	
Surface Mining Control and Reclamation Act	30 USC §§ 1201 through 1326 30 CFR Part 816; 30 CFR Part 784	Protects the environment from effects of surface coal mining operations.	Relevant and Appropriate	B-8

TABLE 6-2
SUMMARY OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
TOSTON SMELTER SITE

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable Relevant and Appropriate	Appendix Page Reference
Contaminant-Specific				
Montana Water Quality Act	75-5-101 et seq.	Establishes Montana's standard for nondegradation of water quality. It applies to surface water that has quality higher than the established water quality standards and is designed to maintain existing high water quality.	Applicable	C-1
Surface Water Quality Standards and Procedures	17.30.601-629	Provides the water use classification for various streams and imposes specific water quality standards per classification.	Applicable	C-2
	17.30.635-646	Imposes waste treatment requirements to restore and maintain the quality of surface water to applicable water use categories. Treatment standards are based on the state's policy of nondegradation, and present and anticipated beneficial uses of the receiving waters.	Applicable	C-2
Nondegradation of Water Quality	17.30.701-717	Any activity that would cause a new or increased source of pollution to state waters is subject to Montana's nondegradation policy. If degradation is allowed due to necessary economic and social development, it may not result in harmful effects to public health, recreation, safety, welfare, livestock, wild birds, fish and other wildlife, or other beneficial uses.	Applicable	C-4
Montana Pollutant Discharge Elimination System (MPDES)	17.30.1201-1209	Establishes technology-based treatment for MPDES permits.	Applicable	C-4
	17.30.1301-1347	Establishes common system for issuing permits for point sources discharging pollutants into state water.	Relevant and Appropriate	C-4

TABLE 6-2 (Continued)
SUMMARY OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
TOSTON SMELTER SITE

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable Relevant and Appropriate	Appendix Page Reference
Montana Groundwater Pollution Control System	17.30.1002	Classifies groundwater into Classes I through IV based on the present and future most beneficial uses of the groundwater, and states that groundwater is to be classified to actual quality or actual use, whichever places the groundwater in a higher class.	Applicable	C-4
	17.30.1003	Establishes groundwater quality standards for groundwater classification, and should be consulted.	Applicable	C-4
	17.30.1011	Requires any groundwater that has existing quality higher than the standard for its classification to be maintained at that high quality unless the Board of Health is satisfied that a change is justifiable for economic or social development and will not preclude present or anticipated use of such waters, and defines degradation.	Applicable	C-4
<u>Clean Air Act of Montana</u>	75-2-101 <u>et</u> <u>seq</u>.	Purpose is to achieve and maintain such levels of air quality as will protect human health and safety and, to the greatest degree practicable, prevent injury to plant and animal life and property, foster the comfort and convenience of the people, promote economic and social development, and facilitate enjoyment of the natural attractions of the State of Montana.	Applicable	C-5
Air Quality Regulations	16.8.815	No person shall cause or contribute to concentrations of lead in the ambient air which exceed the following 90-day average: 1.5 micrograms per cubic meter of air.	Applicable	C-5
	16.8.818	No person shall cause or contribute to concentrations of particulate matter in the ambient air such that the mass of settled particulate matter exceeds the following 30-day average: 10 grams per square meter.	Applicable	C-5
	16.8.821	No person may cause or contribute to concentrations of PM-10 (particulate matter that is 10 microns in diameter or smaller) in the ambient air which exceed the following standard: (1) 24-hour average: 150 micrograms per cubic meter of air, with no more than one expected exceedance per calendar year; (2) annual average: 50 micrograms per cubic meter of air.	Applicable	C-5

TABLE 6-2 (Continued)
SUMMARY OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
TOSTON SMELTER SITE

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable Relevant and Appropriate	Appendix Page Reference
Air Quality Regulations (Cont.)	16.8.1401	States "no person shall cause or authorize the production, handling, transportation or storage of any material unless reasonable precautions to control emissions of airborne particulate matter are taken."	Applicable	C-6
	16.8.1404	States no person shall cause opacity for more than 20 percent over 6 minutes.	Applicable	C-6
	16.8.1424	Sets forth emission standards for hazardous air pollutants.	Applicable	C-6
	26.4.761	Requires a fugitive dust control program be implemented in reclamation operations, and lists specific components of such a program.	Relevant and Appropriate	C-6
Occupational Health Act	50-70-101 et seq.	Establishes standards necessary to protect workers from occupational hazards.	Applicable	C-6
Occupational Air Contaminants Requirements	16.42.102	Establishes maximum threshold limit values for air contaminants under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects.	Applicable	C-6
Public Water Supplies Act	75-6-101 et seq.	Establishes applicable public policy of Montana to "protect, maintain, and improve the quality and potability of water for public water supplies and domestic uses."	Relevant and Appropriate	C-7
	17.38.205	Establishes the following maximum turbidity contaminant level for public water supply system.	Relevant and Appropriate	C-7
	17.30.1206	Adopts and incorporates language for toxic pollutant effluent standards found in 40 CFR Part 129.	Relevant and Appropriate	C-7
	17.30.1207	Adopts and incorporates language for effluent limitations and standards of performance found in 40 CFR Subchapter N (Parts 401-471, except Part 403).	Relevant and Appropriate	C-7

TABLE 6-2 (Continued)
SUMMARY OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
TOSTON SMELTER SITE

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable Relevant and Appropriate	Appendix Page Reference
Location-Specific				
Flood Plain and Floodway Management Act	76-5-401	Limits the uses permissible in a floodway and generally prohibits permanent structures, fill, or permanent storage of materials or equipment.	Relevant and Appropriate	C-8
Flood Plain Management Regulations	76-5-402 and 403	Lists the permissible permanent structures that are allowed in the flood plain excluding the floodway and provides certain minimum standards.	Applicable	C-8
	36.15.216	The factors to consider in determining whether a permit should be issued to establish or alter an artificial obstruction or nonconforming use in the flood plain or floodway are provided in this section.	Applicable	C-8
	36.15.602	Specifies conditions for allowing obstruction in the floodway and lists uses requiring permits.	Applicable	C-8
	36.15.603	Proposed diversions or changes in place of diversions must be evaluated by the Department of Natural Resources and Conservation to determine whether they may significantly affect flood flows and, therefore, require a permit.	Applicable	C-8
	36.15.604	Prohibits new artificial obstructions or nonconforming uses that will increase the upstream elevation of the flood base 0.5 feet or significantly increase flood velocities.	Applicable	C-8
	36.15.605	Identifies artificial obstructions and nonconforming uses that are prohibited within the designated floodway except as allowed by permit and includes "a structure or excavation that will cause water to be diverted from the established floodway, cause erosion, obstruct the natural flow of water, or reduce the carrying capacity of the floodway...". Solid flammable or explosive materials are also prohibited.	Applicable	C-8

TABLE 6-2 (Continued)
SUMMARY OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
TOSTON SMELTER SITE

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable Relevant and Appropriate	Appendix Page Reference
Flood Plain Management Regulations (Continued)	36.15.606	Identifies flood control works that are allowed with designated floodways pursuant to permit and certain conditions including: flood control levies and flood walls, riprap, channelization projects, and dams.	Applicable	C-9
	36.15.701	Describes allowed uses in the flood fringe.	Applicable	C-9
	36.15.703	Describes prohibited uses within the flood fringe (i.e., areas in the flood plain, but outside the designated floodway)	Applicable	C-9
Natural Streambed and Land Preservation Act	87-5-501,502, and 504	Fish and wildlife resources are to be protected and no construction project or hydraulic project shall adversely affect game or fish habitat.	Relevant and Appropriate	C-9
Antiquities Act	22-3-424	Heritage and paleontological sites are given appropriate consideration.	Relevant and Appropriate	C-9
	22-3-433	Evaluation of environmental impacts includes consultation with the state historic preservation officer (SHPO).	Relevant and Appropriate	C-9
	22-3-435	A heritage or paleontological site is to be reported to the SHPO.	Relevant and Appropriate	C-10
Cultural Resource Regulations	12.8.503 and 505-508	Procedures to ensure adequate consideration of cultural values.	Relevant and Appropriate	C-10
Action-Specific				
Clean Air Act of Montana	75-2-101 et seq.	Montana's State policy is to "achieve and maintain such levels of air quality as well as protect human health and safety, prevent injury to plant and animal life and property, foster the comfort and convenience of the people, promote the economic and social development of the State, and facilitate the enjoyment of the natural attractions of this State."	Applicable	C-10

TABLE 6-2 (Continued)
SUMMARY OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
TOSTON SMELTER SITE

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable Relevant and Appropriate	Appendix Page Reference
Air Quality Regulations	16.8.815	No person shall cause or contribute to concentrations of lead in the ambient air which exceed the following 90-day average: 1.5 micrograms per cubic meter of air.	Applicable	C-11
	16.8.1302	Lists certain wastes that may not be disposed of by open burning.	Applicable	C-11
	16.8.1401 through 1404	No person shall cause or authorize the production, handling, transportation, or storage of any material unless reasonable precautions to control emissions of airborne particulate matter are taken.	Applicable	C-11
	26.4.761	Specifies measures that must be implemented to control fugitive dust emissions during certain reclamation activities. Such measures would be relevant and appropriate requirements to control fugitive dust emissions during excavation, earth moving, regrading, and transportation activities conducted as part of the reclamation of the site.	Applicable	C-11
<u>Montana Water Quality Act</u>	75-5-605	Pursuant to this section, it is unlawful to cause pollution of any state waters, to place any wastes in a location where they are likely to cause pollution of any state waters, to violate any permit provision, to violate any provision of the Montana Water Quality Act, to construct, modify, or operate a system for disposing of waste (including sediment, solid waste and other substances that may pollute state waters) which discharge into any state waters without a permit or discharge waste into any state waters.	Applicable	C-11
Surface Water Quality Standards and Procedures	17.30.601-629	Provides for classification of state waters.	Applicable	C-11
	17.30.635	Industrial waste must receive treatment equivalent to the best available control technology.	Applicable	C-11
Surface Water Quality Standards and Procedures (Continued)	17.30.637 & 17.30.640	Requires that the state's surface water be free of substances that will create concentrations or combinations of materials that are harmful to human, animal, plant, or aquatic life. Moreover, no waste may be discharged and no activities may be conducted that can reasonably be expected to violate any of the standards.	Applicable	C-11

TABLE 6-2 (Continued)
SUMMARY OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
TOSTON SMELTER SITE

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable Relevant and Appropriate	Appendix Page Reference
Nondegradation of Water Quality	17.30.701-717	Applies nondegradation requirements to any activity which would cause a new or increased source of pollution to state waters. States when exceptions to nondegradation requirements apply, except that in no event may such degradation affect public health, recreation, safety, welfare, livestock, wild birds, fish and other wildlife or other beneficial uses.	Applicable	C-13
Montana Pollutant Discharge Elimination System (MPDES)	17.30.1201-1209	Technology-based treatment for MPDES permits.	Applicable	C-13
	17.30.1301-1347	Establishes common system for issuing permits for point sources discharging pollutants into state waters.	Relevant and Appropriate	C-14
Montana Groundwater Pollution Control System	17.30.1002	Classifies groundwater into Classes I though IV based on the present and future most beneficial uses of the groundwater, and states that groundwater is to be classified to actual quality or actual use, whichever places the groundwater in a higher class.	Applicable	C-14
	17.30.1003	Establishes the groundwater quality standards for groundwater classification.	Applicable	C-14
	17.30.1011	Requires that any groundwater with existing quality higher than the standard for its classification must be maintained at that high quality unless the Board of Health is satisfied that a change is justifiable for economic or social development and will not preclude present or anticipated use of such waters and defines degradation.	Applicable	C-14
Groundwater Act	85-2-505	Precludes the wasting of groundwater. Any well producing waters that contaminate other waters must be plugged or capped, and wells must be constructed and maintained so as to prevent waste, contamination, or pollution of groundwater.	Applicable	C-15

TABLE 6-2 (Continued)
SUMMARY OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
TOSTON SMELTER SITE

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable Relevant and Appropriate	Appendix Page Reference
Solid Waste Management Act	75-10-201 et seq.	The Montana Legislature has found that the "health and welfare of the Montana citizens are being endangered by improperly operated solid waste management systems and by the improper and unregulated disposal of wastes." Therefore, Montana has declared that it is the state's public policy to "control solid waste management systems to protect the public health and safety and to conserve natural resources whenever possible."	Applicable	C-15
Solid Waste Management Regulations	16.14.504 & 505 and 508-509	The standards for solid waste disposal are set forth in this provision and include: preclusion against location of solid waste disposal sites in a 100-year flood plain, a requirement that sites be located only in areas that will prevent the pollution of ground and surface waters and public and private water supplies, a requirement for drainage structures to be installed where necessary to prevent surface runoff from entering disposal areas, and a requirement that sites be located to allow for reclamation and reuse of the land.	Applicable or Relevant and Appropriate	C-15
	16.14.520 & 521	General operational and maintenance requirements for solid waste management systems are established pursuant to this section. This section requires that solid waste disposal be confined to areas within the disposal site that can be effectively maintained and operated.	Applicable	C-16
	16.14.523	Solid waste must be transported in such a manner as to prevent its discharge, dumping, spilling or leaking from the transport vehicle.	Applicable	C-16
Hazardous Waste Management Act	75-10-401 et seq.	It is the policy of the state to "protect the public health and safety, the health of living organisms, and the environment from the effects of the improper, inadequate, or unsound management of hazardous waste."	Applicable	C-16

TABLE 6-2 (Continued)
SUMMARY OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
TOSTON SMELTER SITE

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable Relevant and Appropriate	Appendix Page Reference
Montana Hazardous Waste Regulations	16.44.701-703	By reference to federal regulatory requirements, these sections establish the standards for all permitted hazardous waste management facilities. Pertinent provisions may include (by reference to the federal regulations as incorporated in the Montana regulations): groundwater protection requirements in 40 CFR 264.91-101, closure and post-closure requirements in 40 CFR 264.111-120, surface impoundment provisions set out in 40 CFR 264.226-228, and landfill requirements set out in 40 CFR 264.303, 309 and 310. Of particular concern are Resource Conservation and Recovery Act landfill closure requirements. (1) 40 CFR 265.11 (incorporated by reference in Administrative Rules of Montana [ARM] 16.44.702) establishes that hazardous waste management facilities must be closed in such a manner as to minimize the need for further maintenance and to control, minimize or eliminate, to the extent necessary to protect public health and the environment, post-closure escape of hazardous wastes, hazardous constituents, leachate, contaminated runoff or hazardous waste decomposition products to the ground or surface waters or to the atmosphere. (2) 40 CFR 264.228(a) (incorporated by reference by ARM 16.44.702) requires that at closure, free liquids must be removed or solidified, the wastes stabilized, and the waste management unit covered. (3) 40 CFR 264.228 and 310 (incorporated by reference by ARM 16.44.702) requires that surface impoundments and landfill caps must: (a) provide long-term minimization of migration of liquids through the unit; (b) function with minimum maintenance; (c) promote drainage and minimize erosion or abrasion of the final cover; (d) accommodate settling and subsidence; and (e) have a permeability less than, or equal to, the permeability of the natural subsoil present.	Relevant and Appropriate	C-16

TABLE 6-2 (Continued)
SUMMARY OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
TOSTON SMELTER SITE

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable Relevant and Appropriate	Appendix Page Reference
Montana Hazardous Waste Regulation (Continued)	16.44.701-703	(4) 40 CFR 264.228 and 310 (incorporated by reference by ARM 16.44.703) specifies the dimensions of waste disposal units, together with the types and amounts of waste disposed of in each unit. Additionally, the owner must record a deed restriction, in accordance with state law, that will in perpetuity notify potential purchasers that the property has been used for waste disposal and that its use is restricted.	Relevant and Appropriate	C-16
	16.44.109-113	Establishes permit conditions.	Relevant and Appropriate	C-16
	16.44.119-120	Establishes contents of a permit application.	Relevant and Appropriate	C-16
<u>Montana Strip and Underground Mine Reclamation Act</u>	82-4-201 <u>et seq.</u> 26.4	These sections of the Reclamation Act contain specific reclamation objectives. The sections provide requirements for backfilling, grading, hydrology, topsoiling, revegetation, and protection of wildlife and air resources.	Relevant and Appropriate	C-17

7.0 RECLAMATION OBJECTIVES AND GOALS

The overall objective of the Toston Smelter site reclamation project is to protect human health and the environment in accordance with the guidelines set forth by the NCP. Specifically, site reclamation must limit human and ecological exposure to mine-related contaminants and reduce the mobility of those contaminants through associated solid media, groundwater, and surface water exposure pathways. The final reclamation objectives, including the specific amount of contaminant exposure and mobility reduction required, will be determined after site characterization, risk assessment, and the ARARs analysis are completed.

Preliminary remediation goals (PRG) are contaminant-specific and media-specific numbers that reflect potential cleanup levels at the Toston Smelter site. PRGs have been established for the Toston Smelter site to guide investigation activities and to identify areas and media that may require reclamation. PRGs for the Toston Smelter site are shown in Table 7-1. The PRGs are based on federal and state water quality standards or on risk-based concentration values. Risk-based concentration values are available from EPA Region 3 and from MDEQ. The risk-based numbers are calculated for different contaminants and the recreational visitor exposure pathway using standard EPA risk assessment methodology. The following text presents the risk-based concentrations for soil.

Analysis of solid matrix samples (which include soils, slag, speiss, and sulfide wastes) collected during the MDEQ/MWCB hazardous materials inventory (Pioneer 1997) indicate that slag, speiss, and sulfide wastes contain concentrations of arsenic and lead above background concentrations, at levels of potential concern.

There are currently no promulgated standards for metal concentrations in soil. To assist in investigation planning and reclamation option selection and development, EPA Region 3 has developed risk-based PRGs. In addition, the MDEQ has developed a conservative set of risk-based guidelines that are calculated for different contaminants using a recreational visitor exposure pathway scenario. The guidelines take into account the possibility of exposure through multiple exposure routes. The PRGs are intended to help investigators plan reclamation actions but are not to be used to determine site risks. Action levels for soils at the Toston Smelter site have been determined based on risk assessment results generated during the RI. The soil PRGs for the metals of concern are listed in Table 7-1.

TABLE 7-1

PRELIMINARY REMEDIATION GOALS AND APPLICABLE MONTANA CLEANUP GUIDELINES FOR SOIL (mg/kg) TOSTON SMELTER SITE

Contaminant	EPA Region 3 Residential PRGs	MDEQ/MWCB Cleanup Guidelines
Arsenic	23 [a]	323 [b]
Copper	3,100	54,200
Lead	400[c]	2,200
Zinc	23,000	440,000

Notes:

[a] Arsenic PRG is calculated for the noncancer endpoint. The cancer PRG is 0.43 mg/kg.

[b] Arsenic cleanup guideline is calculated for the noncancer endpoint. The cancer cleanup guideline is 1.39 mg/kg (Tetra Tech 1996).

[c] Using standard assumptions the EPA Blood lead model results in maximum residential concentrations of 400 mg/kg.

8.0 IDENTIFICATION AND SCREENING OF RESPONSE ACTIONS, TECHNOLOGY TYPES, AND PROCESS OPTIONS

The waste materials, or potential source materials, at the Toston Smelter site were separated into three waste types in order to facilitate the evaluation of reclamation alternatives. The three waste types are slag, speiss, and sulfide wastes (see Exhibit 1). The selection of the appropriate reclamation alternatives for the entire Toston Smelter site will depend on the following: (1) the nature and types of waste materials; (2) the concentration of metals and other contaminants in the waste materials, (3) the volume of waste materials, and (4) the applicability of the reclamation alternatives. During the selection process, the reclamation alternatives were subjected to three phases of screening or evaluation. These phases included initial screening, alternative screening, and detailed analysis (EPA 1988). The results of the initial screening and alternative screening selection process are described in sections 8.1 and 8.2. The detailed analysis of the reclamation alternatives is presented in Section 9.0.

8.1 IDENTIFICATION AND INITIAL SCREENING OF RECLAMATION ALTERNATIVES

Reclamation alternatives for the Toston Smelter site were first identified by describing general response actions that would satisfy the reclamation objectives. General response actions were progressively refined into technology types and process options. The process options were screened and the retained technologies and process options were combined into potential site-wide reclamation alternatives.

After identifying the potential reclamation alternatives, the alternatives were subjected to initial screening, which is the first step in the alternative selection process. The purpose of the initial screening is to eliminate options that are not feasible from further consideration and retain those options that are potentially feasible. In addition, general response actions, technologies, and process options are evaluated for contaminated solid media only. No technology evaluation has been conducted for surface water, groundwater, or off-site stream sediments. This decision was based primarily on the presumption that remediating the contaminated source materials will subsequently reduce or eliminate any impacts to surface water and groundwater at the site. Separate, feasible reclamation alternatives may exist for each waste type found at the smelter site.

General response actions, technologies, and process options potentially capable of meeting the reclamation objectives for the solid media at the smelter site are identified in Table 8-1. Response actions include no action, institutional controls, engineering controls, excavation and treatment, and in-

TABLE 8-1

GENERAL RESPONSE ACTIONS, TECHNOLOGY TYPES, AND PROCESS OPTIONS TOSTON SMELTER SITE

General Response Action	Technology Type	Process Options
No Action	None	None
Institutional Controls	Access Restrictions	Fencing/Barrier
		Land Use Control
Engineering Controls	Surface Controls	Consolidation
		Grading
		Revegetation/Erosion Protection
	Containment	Earthen Cap
		Earthen Cap with Geomembrane Liner
	On-Site Disposal	Earthen Cap
		Earthen Cap with Geomembrane Liner
		Modified RCRA Subtitle C Repository
		RCRA Subtitle C Repository
	Off-Site Disposal	Solid Waste Landfill
		RCRA Subtitle C Landfill
Excavation and Treatment	Fixation/Stabilization	Cement/Silicates
	Reprocessing	Milling/Smelting
	Physical/Chemical Treatment	Soil Washing
		Acid Extraction
		Alkaline Leaching
	Thermal Treatment	Rotary Kiln
		Vitrification
In-Place Treatment	Physical/Chemical Treatment	Soil Flushing
		Stabilization
		Dewatering
	Thermal Treatment	Vitrification

place treatment. The following paragraphs describe the results of the initial screening of the reclamation alternatives for the Toston Smelter site.

8.1.1 No Action

Under the no action option, no reclamation actions would occur at the site. The no action response is a stand-alone response that is used as a baseline against which other reclamation alternatives are compared. The no action alternative will be retained through the detailed analysis of alternatives.

8.1.2 Institutional Controls

Institutional controls can be used to protect human health and the environment by precluding future access to, or development of, affected areas. In addition, these restrictions may be used to protect an implemented remedy. Potentially applicable institutional controls consist of land use and access restrictions. Land use restrictions would limit potential future uses of the land that could result in unacceptable risks due to human exposure to site contamination or loss of remedy integrity.

Access restrictions typically include physical barriers, such as fencing, that could prevent both human and wildlife access to the site to preclude exposure to site contamination and to protect the integrity of the remedy.

Institutional controls could be implemented as a stand-alone remedy, or in combination with other alternatives. Institutional controls that are developed as part of an alternative for the Toston Smelter site would likely be enforced by the local government. Therefore, this entity would need to be involved in developing and eventually implementing any institutional controls.

This type of action does not, in itself, achieve a specific cleanup goal. Considering the baseline risks posed by contaminants at the site, institutional controls alone are not considered adequate to mitigate these potential human health and ecological risks. However, institutional controls will be considered in conjunction with other reclamation alternatives.

8.1.3 Engineering Controls

Engineering controls are used primarily to reduce the mobility of, and exposure to, contaminants. These goals are accomplished by creating a barrier that prevents direct exposure and transport of waste from the contaminated source to the surrounding media. Engineering controls do not reduce the volume or toxicity of the hazardous material. Engineering controls typically applied include containment/capping, revegetation, runon/runoff control, and disposal in a repository. These engineering controls are discussed in the following subsections.

8.1.3.1 Surface Controls

Surface control measures are used primarily to reduce contaminant mobility, and limit direct exposure. Surface controls may be appropriate in more remote areas where direct human contact is not a primary concern (human receptors are not living or working directly on or near the site). Surface control process options include consolidation, grading, revegetation, and erosion protection. These process options are usually integrated as a single reclamation alternative.

Consolidation involves grouping similar waste types in a common area for subsequent management or treatment. Excavation during consolidation is accomplished with standard earthmoving equipment including scrapers, bulldozers, excavators, loaders, and trucks. Consolidation is especially applicable when multiple waste sources are present at a site and one or more of the sources require removal from particularly sensitive areas (that is, floodplain, residential area, or heavy traffic area) or when treating one large combined waste source in a particular location rather than several smaller waste sources dispersed throughout an area. At the Toston Smelter site, precautionary measures would be necessary for excavating materials adjacent to the irrigation canal or protruding into the Missouri River. Containment and treatment of water encountered during excavation may also be necessary. The location of the Missouri River floodplain at the Toston Smelter site could also influence whether wastes are left in place or require removal.

Grading is the general term for techniques used to reshape the ground surface to reduce slopes, manage surface water infiltration and runoff, and to aid in erosion control. The spreading and compaction steps used in grading are routine construction practices. The equipment and methods used in grading are similar for all surfaces, but will vary slightly depending on the waste location and the surrounding terrain. Equipment may included bulldozers, scrapers, graders, and compactors. Periodic maintenance and regrading may be necessary to eliminate depressions formed as a result of settlement, subsidence, or erosion.

Revegetation involves adding soil amendments to the waste surface to provide nutrients, organic material, and neutralizing agents and improve the water storage capacity of the contaminated media, as necessary. Revegetation will provide an erosion-resistant cover that protects the ground surface from surface water and wind erosion and reduces net infiltration through the contaminated medium by increasing evapotranspiration processes. Revegetation can also reduce the potential for direct contact with contaminant sources. In general, revegetation includes the following steps: (1) selecting appropriate plant species, (2) preparing seed bed, which may include deep application of soil amendments, as necessary, (3) seeding/planting, (4) mulching and chemical stabilization, and (5) fertilizing and maintaining.

Erosion protection includes using erosion-resistant materials, such as mulch, natural or synthetic fabric mats, riprap, and surface water diversion ditches to reduce the erosion potential at the surface of the contaminated medium. The erosion-resistant materials are placed in areas susceptible to surface water erosion (concentrated flow or overland flow) or wind erosion. Proper erosion protection design requires knowledge of drainage area characteristics, average slopes, soil texture, vegetation types and abundance, and precipitation data.

Surface controls are considered a feasible option for all waste types at the site and will be retained for further consideration as a reclamation alternative, or in conjunction with other alternatives.

8.1.3.2 Containment

A containment approach leaves waste materials in place and uses capping to reduce or eliminate exposure to, and mobility of, a contaminated medium. Containment source control measures can be used to divert surface water from the contaminated medium and to minimize infiltration (and subsequent formation of leachate) of surface water/precipitation into the underlying contaminated medium. Infiltration can be reduced or prevented by physical barriers or by increasing evapotranspiration processes. The physical capping or covering of wastes during containment reduces or eliminates the potential health risk that may be associated with exposure (via direct contact or inhalation of airborne releases of particulates) to the contaminated media.

Cap or cover design may vary in complexity from a simple earthen cover to a multilayered cap designed to meet Resource Conservation and Recovery Act (RCRA) standards. Factors to consider in cap or cover design include physical conditions of the contaminated media, leachability, site hydrogeology, precipitation, depth to groundwater, current groundwater quality, area groundwater use, and applicable groundwater standards. Stringent cap performance standards may not always be appropriate, particularly in instances where the toxicity of the contaminated medium is relatively low, where the cap is intended to be temporary, where there is very low precipitation, or where the waste is not leached by infiltrating rain water. Specific cap construction is also partially driven by the desired land use following cap construction.

Containment is considered a standard construction practice. Equipment and construction methods associated with containment are readily available, and design methods and requirements are well understood.

Containment is considered a feasible option for all waste types at the site and will be retained for further consideration as a reclamation alternative or in combination with other alternatives. However, the location of the Toston Smelter site within the Missouri River floodplain could ultimately determine whether wastes are left in place or require removal.

8.1.3.3 On-Site Disposal

Permanent, on-site disposal is used as a source control measure and is similar to containment. The objectives of on-site disposal are the same as for containment, except that disposal includes excavation and consolidation of waste into a single, smaller area, and may involve installing physical barriers beneath as well as above the waste. This added barrier (beneath the waste) may be needed to provide additional protection of groundwater from potential leachate contamination.

On-site disposal options may be applied to treated or untreated contaminated materials. As materials are excavated and moved during this process, treatment may become a cost-effective option. The design configuration of an on-site repository would depend on the toxicity and type of material requiring disposal. The design could range in complexity from an earthen cap to an earthen cap with a geomembrane liner, a modified RCRA Subtitle C repository, or a RCRA Subtitle C repository.

Factors to consider in an earthen cover or cap design include physical condition of the contaminated media, leachability, site hydrogeology, precipitation, depth to groundwater, current groundwater quality, area groundwater use, and applicable groundwater standards. Stringent cap performance standards may not always be appropriate, particularly in instances where the toxicity of the contaminated medium is relatively low, where there is very low precipitation, or where the waste is not leached by infiltrating rain water. Desired land use following cap construction should also be considered in cap design.

Uneven terrain and the Missouri River in the smelter slag dump area may require use of specialized equipment or construction methods. At the Toston Smelter site, precautionary measures such as water diversion or isolation would be necessary for excavating materials near the irrigation canal or those protruding into the Missouri River. Containment and treatment of water encountered during excavation may also be necessary. The location of the Toston Smelter site within the Missouri River floodplain could ultimately determine whether wastes can be disposed of on site or require removal to a location outside the floodplain.

Three of the four types of on-site disposal options are considered feasible technologies and will be retained for further evaluation. These options include an earthen cap, an earthen cap with a geomembrane liner, and a modified RCRA Subtitle C repository. The general area within the site boundaries is currently being considered for an on-site repository location.

8.1.3.4 Off-Site Disposal

Off-site disposal involves placing excavated contaminated material in an engineered, licensed disposal facility located outside the site boundary or in an off-site mine waste repository. Off-site disposal options may be applied to pretreated or untreated contaminated materials. Materials failing to meet the toxicity characteristics leaching procedure (TCLP) criteria would be considered hazardous and, if disposed off site, would require disposal in a RCRA-permitted treatment, storage, and disposal (TSD) facility. Conversely, less toxic materials could be disposed of in an off-site mine waste repository or in an off-site permitted sanitary landfill in compliance with other applicable laws.

Excavation and disposal at an off-site mine waste repository is not considered feasible because such a facility is not currently available. Excavation and disposal in a permitted sanitary landfill is not considered feasible because TCLP metals exceeded EPA criteria in some samples. Excavation and disposal in a RCRA Subtitle C landfill are being retained for detailed analysis as an off-site disposal option.

8.1.4 Excavation And Treatment

Excavation and treatment incorporate the removal of contaminated media and subsequent treatment via a specific treatment process that chemically, physically, or thermally results in a reduction of contaminant toxicity and volume. Treatment processes have the primary objective of either: (1) concentrating the metal contaminants for additional treatment or recovery of valuable constituents, or (2) reducing the toxicity of the hazardous constituents.

Excavation can be completed using conventional earth moving equipment and accepted hazardous materials handling procedures. At the Toston Smelter site, precautionary measures such as water diversion or isolation would be necessary for excavating materials near the irrigation canal or those protruding into the Missouri River. Containment and treatment of water encountered during excavation may also be necessary. The location of the Toston Smelter site within the Missouri River floodplain could ultimately determine whether wastes can be disposed of on site or require removal to a location outside the floodplain.

8.1.4.1 Fixation and Stabilization

Fixation and stabilization technologies are used to treat materials by physically encapsulating them in an inert matrix (stabilization) and chemically altering them to reduce the mobility and toxicity of their constituents (fixation). These technologies generally involve mixing materials with binding agents under prescribed conditions to form a stable matrix. Fixation and stabilization are established technologies for treating inorganic contaminants. The technologies incorporate a reagent or combination of reagents to facilitate a chemical and physical reduction of the mobility of contaminants in the solid media. Lime/fly ash-based treatment processes and pozzolan/cement-based treatment processes are potentially applicable fixation and stabilization technologies.

Excavation and subsequent fixation and stabilization treatment are not being retained because other feasible options can provide equal protectiveness.

8.1.4.2 Reprocessing

Reprocessing involves excavating and transporting the waste materials to an existing permitted mill or smelter facility for processing and economic recovery of target metals. Applicability of this option depends on the willingness of an existing permitted facility to accept and process the material and dispose of the waste. Although reprocessing at active facilities has been conducted in the past, permit limitations, CERCLA liability, and process constraints all limit the feasibility of this process option.

Reprocessing is not considered feasible for the material at this site due to the low value of recoverable metals in the material and the high cost of transportation and reprocessing. Other feasible options can provide equal protectiveness.

8.1.4.3 Physical and Chemical Treatment

Physical treatment processes use physical characteristics to concentrate constituents into a relatively small volume for disposal or further treatment. Chemical treatment processes act through the addition of a chemical reagent that removes or fixates the contaminants. The net result of chemical treatment processes is a reduction of toxicity and mobility of contaminants in the solid media. Chemical treatment processes often work in conjunction with physical processes to wash the contaminated media with water, acids, bases, or surfactant. Potentially applicable physical/chemical treatment process options include soil washing, acid extraction, and alkaline leaching.

Soil washing is an innovative treatment process that consists of washing the contaminated medium (with water) in a heap, vat, or agitated vessel to dissolve water-soluble contaminants. Soil washing requires that contaminants be readily soluble in water and sized sufficiently small so that dissolution can be achieved in a practical retention time. Dissolved metal constituents contained in the wash solution are precipitated as insoluble compounds, and the treated solids are dewatered before additional treatment or disposal. The precipitates form a sludge that would require additional treatment, such as dewatering or stabilization before disposal.

Acid extraction applies an acidic solution to the contaminated medium in a heap, vat, or agitated vessel. Depending on temperature, pressure, and acid concentration, varying quantities of the metal constituents present in the contaminated medium would be solubilized. A broader range of contaminants can be expected to be acid soluble at ambient conditions using acid extraction versus soil washing; however, sulfide compounds may be acid soluble only under extreme conditions of temperature and pressure. Dissolved contaminants are subsequently precipitated for additional treatment and disposal.

Alkaline leaching is similar to acid extraction in that a leaching solution (in this case, ammonia, lime, or caustic soda) is applied to the contaminated medium in a heap, vat, or agitated vessel. Alkaline leaching is potentially effective for leaching the majority of metals from the contaminated media; however, the removal of arsenic is not well documented.

Excavation and subsequent physical and chemical treatment are not being retained for further evaluation because other feasible options can provide equal protectiveness.

8.1.4.4 Thermal Treatment

Under thermal treatment technologies, heat is applied to the contaminated medium to volatilize and oxidize metals and render them amenable to additional processing and to vitrify the contaminated medium into a glass-like, nontoxic, nonleachable matrix. Potentially applicable moderate-temperature thermal processes, which volatilize metals and form metallic oxide particulates, include the fluidized bed reactor, the rotary kiln, and the multihearth kiln. Potentially applicable high-temperature thermal treatment processes include vitrification. All components of the contaminated medium are melted and volatilized under high temperature vitrification. Volatile contaminants and gaseous oxides of sulfur are driven off as gases in the process, and the nonvolatile, molten material that contains contaminants is cooled and, in the process, vitrified.

Thermal treatment technologies can be applied to wet or dry contaminated medium; however, the effectiveness may vary somewhat with variable moisture content and particle size. Crushing may be necessary as a pretreatment step, especially for large and variable particle sizes. Moderate-temperature thermal processes should be considered only as pretreatment for other treatment options. This process concentrates the contaminants into a highly mobile (and potentially more toxic) form. High-temperature thermal processes immobilize most metal contaminants into a vitrified slag that would require proper disposal. The volatile metals would be removed or concentrated into particulate metal oxides which would likely require disposal as hazardous waste. Thermal treatment costs are extremely high compared to other potentially applicable reclamation technologies.

Excavation and subsequent thermal treatment are not being retained for further evaluation because other feasible options can provide equal protectiveness.

8.1.5 In-Place Treatment

In-place treatment involves treating the contaminated medium where it is currently located. In-place technologies reduce the mobility and toxicity of the contaminated medium and may reduce worker exposure to the contaminated materials; however, in-place technologies allow a lesser degree of control, in general, than ex situ treatment options.

8.1.5.1 Physical and Chemical Treatment

Potentially applicable in-place physical and chemical treatment technologies include stabilization and solidification, soil flushing, and dewatering.

In-place stabilization and solidification are similar to conventional stabilization in that a solidifying agent (or combination of agents) is used to create a chemical or physical change in the mobility and toxicity of the contaminants. The in-place process uses deep-mixing techniques to allow maximum contact of the solidifying agents with the contaminated medium.

Soil flushing is an innovative process that injects an acidic or basic reagent or chelating agent into the contaminated medium to solubilize metals. The solubilized metals are extracted using established dewatering techniques, and the extracted solution is then treated to recover metals or is disposed of as aqueous waste. Low-permeability materials may hinder proper circulation, flushing solution reaction, and ultimate recovery of the solution. Currently, soil flushing has been demonstrated during pilot tests.

Dewatering is a common pretreatment process used to extract water from contaminated solid medium. Common dewatering options include well-field extraction, extraction trenches, surface water diversion, and gravity draining of stockpiled saturated materials. Dewatering is most effective in conjunction with additional reclamation technologies that reduce contaminant toxicity, mobility, or volume.

In-place physical and chemical treatment is not being retained for further consideration because other feasible options can provide equal or greater protectiveness.

8.1.5.2 Thermal Treatment

In-place vitrification is an innovative process used to melt contaminated solid media in place to immobilize metals into a glass-like, inert, nonleachable solid matrix. Vitrification requires significant energy to generate sufficient current to force the solid medium to act as a continuous electrical conductor. This technology is seriously inhibited by high moisture content. Gases generated by the process must be collected and treated in an off-gas treatment system. In-place vitrification has been demonstrated only at the pilot scale, and treatment costs are extremely high compared to other treatment technologies.

In-place thermal treatment is not being retained for further consideration because other feasible options can provide equal or greater protectiveness.

8.1.6 Reclamation Alternative Initial Screening Summary

The reclamation alternatives that were retained from the initial screening underwent an alternative screening, which is the second step in the selection process. A summary of the initial screening of alternatives is provided in Table 8-2.

8.2 SCREENING SUMMARY AND IDENTIFICATION OF RECLAMATION ALTERNATIVES

A summary of the initial screening of reclamation response actions, technologies, and process options is provided in Table 8-2. The next step in the evaluation and selection process for a reclamation alternative is alternative screening. The purpose of alternative screening is to compare the identified options based on the NCP criteria of effectiveness, implementability, and relative costs, and eliminate alternatives to reduce the number carried forward for detailed analysis. Alternatives can be eliminated from further consideration if they do not meet the effectiveness or implementability criteria. Also, an alternative can be eliminated if its cost is substantially higher than other alternatives, and at least one other alternative is retained that offers equal protectiveness. This second level of alternative screening is effective as a method of reducing the number of options requiring a subsequent detailed analysis.

TABLE 8-2
RECLAMATION TECHNOLOGY SCREENING COMMENTS SUMMARY
SOLID MEDIA
TOSTON SMELTER SITE

General Response Actions	Reclamation Technology	Process Options	Description	Screening Comment
NO ACTION	None	Not applicable	No action	Not applicable
INSTITUTIONAL CONTROLS	Access Restrictions	Fencing/Barrier	Install fences around waste areas to limit access	Potentially effective in conjunction with other technologies; readily implementable
		Land Use Control	Implement restrictions to control current and future land use	Potentially effective in conjunction with other technologies; readily implementable
ENGINEERING CONTROLS	Surface Controls	Consolidation, Grading, Revegetation, Erosion Protection	Combine similar waste types in a common area; level out waste piles to reduce slopes for managing surface water infiltration, runoff, and erosion; add amendments to waste and seed with appropriate vegetative species to establish an erosion-resistant ground surface	Potentially effective in conjunction with other process options assuming waste does not contain high concentrations of phytotoxic chemicals; limits direct exposure; readily implementable
	Containment	Earthen Cap	Apply soil and establish vegetative cover to stabilize surface; waste materials are left in place	Surface infiltration and runoff potential would be reduced, but not prevented; limits direct exposure; readily implementable
		Earthen Cap with Geomembrane Liner	Install geomembrane liner with soil/vegetation over surface; waste materials are left in place	Surface infiltration and runoff potential would be significantly reduced, or eliminated; limits direct exposure; readily implementable
	On-Site Disposal	Earthen Cap	Excavate waste materials and deposit on site in a constructed repository with an earthen cap	Surface infiltration and runoff potential would be reduced, but not prevented; limits direct exposure; readily implementable
		Earthen Cap with Geomembrane Liner	Excavate waste materials and deposit on site in a constructed repository with an earthen cap and geomembrane liner	Surface infiltration and runoff potential would be significantly reduced, or eliminated; limits direct exposure; readily implementable

TABLE 8-2 (Continued)
RECLAMATION TECHNOLOGY SCREENING COMMENTS SUMMARY
SOLID MEDIA
TOSTON SMELTER SITE

General Response Actions	Reclamation Technology	Process Options	Description	Screening Comment
ENGINEERING CONTROLS (Continued)	On-Site Disposal	Modified RCRA Subtitle C Repository	Excavate waste materials and deposit on site in a constructed modified RCRA Subtitle C Repository	Surface infiltration and runoff potential would be significantly reduced, or eliminated; limits direct exposure; readily implementable
		RCRA Subtitle C Repository	Excavate waste materials and deposit on site in a constructed RCRA Subtitle C Repository	Not readily implemented. Off-site RCRA Subtitle C Landfill retained.
	Off-Site Disposal	Modified RCRA Subtitle C Repository	Excavate waste materials and deposit on site in a constructed modified RCRA Subtitle C Repository	Surface infiltration and runoff potential would be effectively eliminated; limits direct exposure; readily implementable if site available for repository construction
		Solid Waste Landfill	Excavate and dispose of nonhazardous solid wastes permanently in a non-RCRA facility	Potentially effective for nonhazardous materials or nonhazardous residues from other treatment process options; readily implementable, but cost prohibitive
		RCRA Subtitle C Landfill	Excavate and dispose of wastes permanently in a RCRA-permitted facility	Potentially effective, and readily implementable; but cost prohibitive
EXCAVATION AND TREATMENT	Fixation/ Stabilization	Cement/Silicates	Incorporate hazardous constituents into non-leachable cement or pozzolan solidifying agents	Extensive treatability testing required; proper disposal of stabilized product would be required; potentially implementable, but cost-prohibitive
	Reprocessing	Milling/Smelter	Ship wastes to existing milling/smelter facility for economic extraction of metals	Potentially effective but a facility is not located in the area
	Physical/ Chemical Treatment	Soil Washing	Separate hazardous constituents from solid media via dissolution and subsequent precipitation	Effectiveness is questionable; potential exists to increase mobility by providing partial dissolution of contaminants; more difficulty encountered with wider range of contaminants
		Acid Extraction	Mobilize hazardous constituents via acid leaching and recover by subsequent precipitation	Effectiveness is questionable; sulfides would be acid soluble only under extreme conditions of temperature and pressure

TABLE 8-2 (Continued)
RECLAMATION TECHNOLOGY SCREENING COMMENTS SUMMARY
SOLID MEDIA
TOSTON SMELTER SITE

General Response Actions	Reclamation Technology	Process Options	Description	Screening Comment
EXCAVATION AND TREATMENT (Continued)	Physical/ Chemical Treatment	Alkaline Leaching	Use alkaline solution to leach contaminants from solid media in a heap, vat, or agitated vessel	Effectiveness is not well documented for arsenic
	Thermal Treatment	Fluidized Bed Reactor/Rotary Kiln/Multihearth Kiln	Concentrate hazardous constituents into a small volume by volatilization of metals and formation of metallic oxides as particulates	Further treatment is required to treat process by-products; potentially implementable, but cost prohibitive
		Vitrification	Use extremely high temperature to melt and/or volatilize all components of the solid media; the molten material is cooled and, in the process, vitrified into a nonleachable form	Further treatment is required to treat process by-products; potentially implementable, but cost prohibitive
IN-PLACE TREATMENT	Physical/ Chemical Treatment	Stabilization	Stabilize waste constituents in place when combined with injected stabilizing agents	Extensive treatability testing required; potentially implementable, but cost prohibitive
		Solidification	Use solidifying agents in conjunction with deep soil mixing techniques to facilitate a physical or chemical change in mobility of the contaminants	Extensive treatability testing required; potentially implementable, but cost prohibitive
		Soil Flushing	Acid/base reagent or chelating agent injected into solid media to solubilize metals; solubilized reagents are subsequently extracted using dewatering techniques	Effectiveness not certain; innovative process currently in its pilot stage
	Thermal Treatment	Vitrification	Subject contaminated solid media to extremely high temperature in place; during cooling, material is vitrified into non-leachable form	Difficulties may be encountered in establishing adequate control; potentially implementable, but cost prohibitive

Note: Eliminated alternatives are shaded.

The reclamation response actions, technologies, and process options that were retained have been combined into the reclamation alternatives shown in Table 8-3. Five feasible reclamation alternatives were identified. Because this number of alternatives is not unreasonably high, and since none of these alternatives could obviously be eliminated through an additional screening step, all of these alternatives will be carried through to the detailed analysis.

TABLE 8-3

**RECLAMATION ALTERNATIVE INITIAL SCREENING SUMMARY
TOSTON SMELTER SITE**

Solid Media	List of Alternatives
Alternative 1	No Action
Alternative 2	Institutional Controls
Alternative 3	Containment
Alternative 4	Excavation and On-Site Disposal
Alternative 5	Excavation and Off-Site Disposal

9.0 DETAILED ANALYSIS OF RECLAMATION ALTERNATIVES

The third step in the selection process for reclamation alternatives for the Toston Smelter site is the detailed analysis. The purpose of the detailed analysis is to evaluate the screened reclamation alternatives for their effectiveness, implementability, and cost in order to control and reduce toxicity, mobility, and volume of smelter wastes at the Toston Smelter site.

As required by CERCLA and the NCP, reclamation alternatives that were retained after the initial and alternative screening selection processes were evaluated individually against the following criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Supporting agency acceptance and community acceptance are additional criteria that will be addressed after the MWCB and the public review the alternative evaluations presented. These analysis criteria have been used to address the CERCLA requirements and considerations with EPA guidance (1988), as well as additional technical and policy considerations. Analysis criteria also serve as the basis for conducting the detailed analysis and subsequently selecting the preferred reclamation alternative. The criteria listed above are categorized into three groups, each with distinct functions in selecting the preferred alternative. These groups include:

- **Threshold Criteria** - overall protection of human health and the environment and compliance with ARARs.
- **Primary Balancing Criteria** - long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness, implementability, and cost.
- **Modifying Criteria** - state and community acceptance.

Overall protection of human health and the environment and compliance with ARARs are threshold criteria that must be satisfied for an alternative to be eligible for selection. Long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability; and cost are the primary balancing criteria used to weigh major trade-offs among alternative hazardous waste management strategies. State and community acceptance are modifying criteria that are formally considered after public comment is received on the proposed reclamation approach and the EEE/CA report. Each criterion is presented and described further in Table 9-1.

The final step of this analysis is to conduct a comparative analysis of the alternatives. The analysis will discuss each alternative's relative strengths and weaknesses with respect to each of the criteria, and how reasonably key uncertainties could change expectations of their relative performance. Once completed, this evaluation will be used to select the preferred alternative(s). The selection will be documented in a Record of Decision (ROD). Public meetings to present the alternatives will be conducted and significant oral and written comments will be addressed in writing.

The reclamation alternatives which were retained after the initial and alternative screening selection processes performed in Section 8.0 are included in the detailed analysis. Each reclamation alternative under consideration for use at the Toston Smelter site is classified as an interim or removal action, and is

TABLE 9-1

ANALYSIS OF SCREENED RECLAMATION ACTIVITIES
TOSTON SMELTER SITE

THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment	Compliance with ARARs
• How alternative provides human health and environmental protection	• Compliance with chemical-specific ARARs • Compliance with action-specific ARARs • Compliance with location-specific ARARs • Compliance with other criteria, advisories, and guidance (TBCs)

PRIMARY BALANCING CRITERIA

Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost
• Magnitude of residual risk • Adequacy and reliability of controls	• Treatment process used and materials treated • Amount of hazardous materials destroyed or treated • Degree of expected reductions in toxicity, mobility, and volume • Degree to which treatment is irreversible • Type and quantity of residuals remaining after treatment	• Protection of community during removal actions • Protection of workers during removal actions • Environmental impacts • Time until removal action objectives are achieved	• Ability to construct and operate the technology • Reliability of the treatment • Ease of undertaking additional removal actions, if necessary • Ability to obtain approvals from other agencies • Coordination with other agencies • Availability of off-site treatment, storage, and disposal services and capability • Availability of necessary equipment and specialists • Availability of prospective technologies	• Capital costs • Operating and maintenance costs • Present worth cost

TABLE 9-1
(Continued)
ANALYSIS OF SCREENED RECLAMATION ACTIVITIES
TOSTON SMELTER SITE

MODIFYING CRITERIA	
Supporting Agency Acceptance[a]	**Community Acceptance[a]**
• Features of the alternative the supporting agencies support • Features of the alternative about which the supporting agencies have reservations • Elements of the alternative the supporting agencies strongly oppose	• Features of the alternative the community supports • Features of the alternative about which the community has reservations • Elements of the alternative the community strongly opposes

Note:

[a] These criteria are being assessed primarily following pubic comment on the RI report (TtEMI 1998) and the expanded engineering evaluation/cost analysis.

not considered a complete reclamation action. In addition, the reclamation alternatives are applicable to the solid media only; no reclamation alternatives were developed for treatment of groundwater, surface water, or off-site stream sediments. The rationale for not directly developing alternatives for these media was based on the presumption that remediating the solid media will subsequently reduce or eliminate the potential impacts to groundwater, surface water, and off-site stream sediments.

9.1 EVALUATION OF THRESHOLD CRITERIA

In the following detailed evaluations of the threshold criteria, each reclamation alternative was assessed for overall risk reduction, and evaluated for ARARs compliance. To assess the threshold criteria (overall protection of human health and the environment, and attainment of ARARs), the exposure pathways of concern (inhalation and dermal) that were identified in the risk assessment were evaluated to determine the risk reduction required in order to achieve the desired residual risk level (HQ $\leq$ 1 and/or risk $\leq$ 1.0E-06). Each alternative was evaluated to ascertain the degree of risk reduction achieved, either through reduced contaminant loading to an exposure pathway or reduced surface area available for certain exposures. The resulting risk reduction estimates were then compared to one another to determine whether the relative risk reduction provided by a specific alternative is greater than another; these risk reductions were also compared to the reduction required to alleviate excess risk via the specific pathway or media. The risk reduction models also estimated resultant contaminant concentrations in the various media, which were then compared to media- and contaminant-specific ARARs.

Modeling estimates and assumptions were used in an attempt to quantify risk reduction and determine whether ARARs would be attained. In the course of performing this quantitative analysis, several assumptions and estimates were used. Some of the assumptions were based on standard CERCLA risk assessment guidance, while others were based on site-specific observation and professional judgment. Many of the estimates were based on conservative or worst case scenarios, but since alternatives were compared to one another, these assumptions were consistent. The evaluation findings should, therefore, not be considered absolute; however, the relative risk reduction differences between alternatives are meaningful and can be used to evaluate this criterion.

The human health risk assessment considered that the most probable exposure pathways at the Toston Smelter site were a recreational receptor under the rockhound/goldpanner exposure scenario or a recreational receptor under an all terrain vehicle/motorcycle rider (ATV/MR). No potential residential scenarios exist at the Toston Smelter site. The risk assessment concluded that risks to site recreational visitors from exposure to lead and arsenic in site soil could be above threshold levels considered safe by the EPA.

Reduction of human health risks posed by the wastes found at the Toston Smelter site is best addressed by reducing the area of exposed wastes, either by covering or removing contaminated wastes. The evaluation of methods to reduce the exposed contaminated surface area must also consider the long term stability and eventual partial failure of cover or containment systems.

The ecological risk assessment identified two exposure scenarios as determined by EQs greater than one: (1) plant phytotoxicity to arsenic, copper, lead, and zinc, and (2) deer ingestion of lead. The deer ingestion scenario would likely require a reduction in surface soil lead levels to achieve no potential risks to deer. The plant phytotoxicity scenario also requires a reduction in arsenic, copper, lead, and zinc surface concentrations or exposed surface area to achieve no phytotoxic effects (EQ less than or equal to 1). Reduction in phytotoxic effects will be achieved through exposure reduction activities associated with the human health risk exposure evaluations. Again, each of these scenarios must consider the long-term stability and eventual partial failure of cover or containment systems.

9.2 ALTERNATIVE 1: NO ACTION

CERCLA and the NCP require analysis of the no action alternative when evaluating alternatives in detail; the no action alternative is used to provide a baseline for comparing other alternatives. Under this alternative, no permanent reclamation activities would be implemented. Consequently, long-term human health and environmental risks associated with the on-site contamination would probably remain unchanged and could possibly increase due to erosion. This alternative will be considered for all types of waste categories.

9.2.1 Overall Protection of Human Health and the Environment

The no action alternative provides no control of exposure to the contaminated materials and no reduction in risk to human health or the environment. It allows for the continued migration of contaminants and further degradation of air, groundwater, and surface water.

Protection of human health would not be achieved under the no action alternative. Prevention of direct human exposure through the pathways of concern would not be achieved. Ingestion and dermal contact and inhalation of soil containing metals would not be reduced. Protection of the environment would also not be achieved under the no action alternative. Prevention of ecological exposures through all scenarios would not be achieved: (1) plant phytotoxicity would not be reduced; and (2) deer exposure to lead through ingestion would not be reduced. In fact, plant phytotoxicity and deer exposure would probably increase due to continued contaminant migration under a no action alternative.

9.2.2 Compliance With ARARs

A comprehensive list of federal and state ARARs for the Toston Smelter site is summarized in Section 6.0 and presented in detail in Appendices B and C. ARARs are divided into contaminant-specific, location-specific, and action-specific requirements. Under the no action alternative, no contaminated materials would be treated, removed, or actively managed. Consequently, no ARARs apply to the no action alternative.

9.2.3 Long-Term Effectiveness and Permanence

No controls or long-term measures would be placed on the contaminated materials at the site; consequently, all current and future risks would probably remain the same and possibly could increase due to erosion. Therefore, the no action alternative would not be effective at minimizing risks from exposure to these materials.

9.2.4 Reduction of Toxicity, Mobility or Volume Through Treatment

The no action alternative would provide no reduction in toxicity, mobility, or volume of the contaminated materials, and could result in an increase in toxicity and mobility of contaminated materials due to off-site migration of contaminated material due to site erosion.

9.2.5 Short-Term Effectiveness

In the short-term, the no action alternative could pose additional threats to the community or the environment under the current site conditions due to increased migration of contaminants due to site erosion. The time required until reclamation objectives are reached by natural contaminant degradation and erosion cannot be estimated, but would most likely be measured in terms of geologic timeframes.

9.2.6 Implementability

There would be no implementability concerns posed by the no action alternative since no action would be taken.

9.2.7 Costs

The cost for implementing this alternative would be zero since no action would be taken.

9.3 ALTERNATIVE 2: INSTITUTIONAL CONTROLS

Institutional controls were retained as a reclamation alternative for all smelter waste types. This alternative would involve erecting a 6-foot-tall, chain-link fence with three barbed wire strands at the top of the fence around waste areas at the site. For fencing purposes, the site would be divided into two areas, one west and one east of Big Springs Ditch. In addition, gates with signs would be installed to allow access for authorized personnel and to warn unauthorized personnel that the area may be hazardous. This alternative would incorporate land use restrictions for the affected and surrounding areas to limit future property use. Institutional controls will be considered concurrently for all investigation areas.

9.3.1 Overall Protection of Human Health and the Environment

This alternative is not fully protective of human health and the environment. Surface water, groundwater, and air remain potential exposure pathways for contaminants. This option, however, would be effective in protecting humans from direct contact with the waste in the short term. In the long term, site erosion could result in contaminant migration off site. Without proper maintenance, the limited effectiveness of this alternative is further reduced.

9.3.2 Compliance with ARARs

There are no federal or state contaminant-specific ARARs that are required to be met for applying institutional controls at the Toston Smelter site.

Occupational Safety and Health Administration (OSHA) requirements would be met by requiring appropriate safety training for all on-site workers during the construction phase.

Location-specific ARARs are expected to be met without any conflicts. Contacts with appropriate agencies regarding wetlands, flood plains, and historical, cultural, and paleontological remains would be required.

All action-specific ARARs are anticipated to be met including the hydrological regulations contained in the Strip and Underground Mine Reclamation Act. The mining wastes were derived from the benificiation and extraction of ores and are, therefore, assumed to be exempt from federal government regulation through RCRA as hazardous waste.

9.3.3 Long-Term Effectiveness and Permanence

Under the institutional controls alternative, the fence would have to be maintained to ensure it continues to perform as designed; consequently, long-term inspection and maintenance would be required. The long-term effectiveness of the fence would be enhanced by proper installation to ensure the stability under snow cover and spring runoff conditions.

9.3.4 Reduction of Toxicity, Mobility or Volume Through Treatment

The smelter waste toxicity, mobility, and volume are not reduced under the institutional controls alternative.

9.3.5 Short-Term Effectiveness

It is anticipated that the construction phase of this alternative would be accomplished within one field season; therefore, impacts associated with construction would likely be short-term and minimal. On-site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. A measurable short-term impact to the community of Toston, Montana, would include increased vehicular traffic and associated safety hazards; however, the short-term impacts would be minimal.

9.3.6 Implementability

This alternative is both technically and administratively feasible, and could be implemented within one field season. The institutional controls installation would require conventional construction practices; materials and construction methods are readily available.

9.3.7 Costs

The total present worth cost for the institutional controls (Alternative 2) is estimated at $89,643.00. Table 9-2 presents the costs associated with implementing this alternative. The total cost includes the present worth value of 30 years on annual maintenance and monitoring costs, in addition to the capital costs.

Conceptual Design and Cost Assumptions

The costs for the fence were based on construction bids for fencing at similar abandoned mine sites. The estimate included providing and installing a chain-link fence with the appropriate gates and signs. Maintenance costs for the fence would be relatively inexpensive. Three inspections would be conducted annually by MDEQ, and the fence could be maintained indefinitely with an expenditure of 2 percent of the total capital costs per year. None of the smelter waste materials in the area were assumed to be consolidated, graded, or revegetated before fencing.

9.4 ALTERNATIVE 3: CONTAINMENT AND ON-SITE SLAG DISPOSAL

This alternative would include containing most smelter wastes on site and excavation and disposal of solid slag in a small on-site repository. Containing smelter wastes in place involves surface control measures and the construction of a cap (earthen cap or earthen cap with a geomembrane liner). The containment steps include the following: (1) consolidating and regrading the materials, (2) capping the area with the appropriate cover according to the design presented on Figure 9-1, and (3) revegetating the disturbed areas and the cap. The smelter area will probably require storm water and other surface control measures due to the proximity to the Missouri River, uneven terrain, and potential for erosion.

Surface control measures would use selective regrading, minimal coversoil application, and revegetation activities to reestablish drainage channels, minimize erosion, and help establish self-perpetuating plant

TABLE 9-2

COST ESTIMATE - ALTERNATIVE 2
INSTITUTIONAL CONTROLS
TOSTON SMELTER SITE

Cost Item	Quantity	Unit	Unit Cost	Cost
Capital Costs				
Mobilization, Bonding & Insurance	1.00	LS	1,500.00	1,500.00
Provide and Install 6-ft Chain Link Fencing	3,000.00	LF	15.00	45,000.00
Cleanup and Demobilization	1.000	LS	500.00	500.00
Subtotal Construction Costs				47,000.00
Construction Contingencies		15 % of Construction Cost		7,050.00
Engineering Design and Construction Oversight		15 % of Construction Cost		7,050.00
Total Capital Costs				61,100.00
Yearly Operation and Maintenance (O&M) Costs				
Site Inspections	3.00	EA	500.00	1,500.00
Fencing Repairs	1.000	LS	500.00	500.00
Subtotal O&M Costs				2,000.00
O&M Contingencies		15 %		300.00
Total Yearly O&M Cost				2,300.00
Present Worth of O&M Costs Based on 30 Year Life @ 7.00%		PF Factor = 12.41		28,543.00
Total Present Worth				89,643.00

Assumptions: Unit costs based on professional judgment and recent bids for similar work at the other Montana abandoned mine reclamation projects.

Notes:
LS = Lump Sum
LF = Lineal Feet
% = Percent
EA = Each
PF = Present Worth Factor
O&M = Operation and Maintenance

Figure 9-1 Capping (earthen cap and earthen cap with liner) communities. Consolidation involves pushing and hauling the waste into common and smaller areas. Regrading involves recontouring the waste and ground surface to achieve approximate original contours, minimize slope lengths and steepness, and to provide positive drainage. Moderate regrading and recontouring would likely be required due to the proximity to the Missouri River, uneven terrain, and others surface structures. Some of the steeper slopes may require seeding with a hydromulch seeder followed by covering with soil erosion control blankets.

Installation of an earthen cap over the general smelter waste areas would involve applying 18 inches of earthen cover over the regraded smelter wastes and revegetating the disturbed areas. Installation of an earthen cap with a geomembrane liner would involve installing a geotextile liner, a drainage layer, and 30-millimeter flexible membrane, and 6 inches of compacted soil, all beneath the 18-inch earthen cap. The type of cap (earthen cap or earthen cap with a geomembrane liner) to be installed over the waste areas would depend on the following circumstances: (1) the concentration of metals in the smelter wastes; (2) the average amount of precipitation that may infiltrate the cap; (3) regulatory concerns; and (4) the effectiveness and stability of a geomembrane liner on steeper slopes.

Under this alternative only, the solid slag piles at the site would be excavated and disposed of in an on-site, modified RCRA repository. The steps include the following: (1) excavating and preparing the repository subgrade, (2) installing a geocomposite liner and drainage system, (3) excavating and consolidating the solid slag waste materials in the repository, (4) capping the waste with a geocomposite liner and an 18-inch thick earthen cap, and (5) revegetating the repository cap and the disturbed areas. A conceptual design of the modified RCRA repository is shown in Figure 9-2.

The repository would comprise an area of approximately 3,600 square feet and would be located on the south side of the Toston Smelter site between the Big Spring Ditch and the Missouri River. Average waste depth in the repository would be approximately 5 feet. Repository preparation would involve the excavation of clean, native soils within the repository area and stockpiling of this material for later use in the repository cap. It is estimated that approximately 300 cubic yards of soil would require removal in order to locate the repository.

A relatively simple leachate collection and detection system consisting of a coarse gravel drainage layer and perforated polyvinyl chloride (PVC) piping with monitoring standpipes would be designed as an integral part of the repository liner system. This repository drainage layer and the liner would be installed, and the solid slag wastes would then be excavated and placed into the repository. Waste placement would need to proceed cautiously to prevent damage to the liner. As the smelter and slag wastes are placed in the repository, grading and compaction of the waste would be required. The final two feet of waste would be amended with lime to inhibit acid production. A geocomposite cap and 18 inches of soil cover would be placed over the waste. After the geocomposite cap and soil cover are placed over the repository, the repository slopes would be graded to 4 to 1 slopes or less to minimize surface erosion potential and revegetated.

9.4.1 Overall Protection of Human Health and the Environment

The implementation of this alternative would provide an additional level of protection in excess of the institutional control measures (Alternative 2) by further reducing the threat of direct contact with the waste material, as well as reducing the risk of airborne exposure. Containing smelter waste, placing solid slag in a repository, and subsequent revegetation would stabilize the surface by providing additional erosion protection, and decrease the infiltration of precipitation and surface water runoff which may leach contaminants to the groundwater.

Although the threat of direct human exposure would not be eliminated by this alternative over the long term, it would be significantly reduced. The addition of an earthen cap with a geomembrane liner would further reduce the threat of direct human exposure as compared to surface control measures alone. Ingestion and dermal contact, and inhalation of soil containing arsenic and lead would be reduced to acceptable levels. Environmental and ecological exposures through all scenarios including deer ingestion of lead and plant phytotoxicity would also be eliminated or reduced over the long term.

9.4.2 Compliance with ARARs

There are no federal or state contaminant-specific ARARs that are required to be met for containing contaminated smelter wastes in place at the Toston Smelter site. Implementation of this alternative is expected to satisfy air quality regulations because the vegetative covers would stabilize the wastes with respect to fugitive emissions.

OSHA requirements would be met by requiring appropriate safety training for all on-site workers during the construction phase.

Location-specific ARARs are expected to be met without any conflicts. Contacts with appropriate agencies regarding wetlands, floodplains, and historical, cultural, and paleontological remains would be required.

All action-specific ARARs are anticipated to be met including the hydrological regulations contained in the Strip and Underground Mine Reclamation Act. The mining wastes were derived from the benificiation and extraction of ores and are, therefore, assumed to be exempt from federal government regulation through RCRA as hazardous waste. In addition, revegetation requirements contained in the Surface Mining Control and Reclamation Act would be met. State of Montana dust suppression and control requirements are applicable for earth-moving activities associated with this alternative for the control of fugitive dust emissions; these requirements would be met through water application to roads receiving heavy vehicular traffic and to excavation areas, if necessary.

9.4.3 Long-Term Effectiveness and Permanence

Under this alternative, the cover would have to be inspected to ensure that the vegetation becomes established and continues to perform as designed. Consequently, long-term monitoring and maintenance would be required, especially of the site fencing and the revegetated slopes of the smelter site since the surface is susceptible to erosion. The cover would be susceptible to settlement, surface water ponding, erosion, and disruption of cover integrity by vehicles, deep-rooting vegetation, and burrowing animals.

The long-term effectiveness of capping the smelter waste in place would be enhanced by determining the proper cover design and appropriate grading layout, and by selecting the appropriate plant species for revegetation. Long-term effectiveness would likely be improved by including some hardy metal tolerant plant species in the revegetation seed mixture. In addition, some type of institutional controls, such as fencing, would also be required with the containment option to minimize potential cover damage.

9.4.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The objective of this alternative is to reduce contaminant mobility; the volume or toxicity of the contaminants would not be physically reduced. Consolidating and containing the waste would stabilize these sources and reduce contaminant mobility from surface water and wind erosion with an increased risk reduction compared to institutional control measures alone (Alternative 2). The mobility of the contaminants is expected to be reduced to an extent that would result in an overall risk reduction from all pathways and routes of exposure.

The effectiveness of the earthen cap, by itself, will depend on evaporation and transpiration from the top soil and vegetation to minimize any leachate generation by surface water infiltration through the waste. The earthen cap with a geomembrane liner would provide additional protection from surface water infiltration depending on the stability of the liner on steeper slopes; the drainage layer directly above the flexible membrane liner would effectively transport surface water infiltration away from waste materials. A drainage ditch would be installed at the bottom of the contoured area to capture any potential surface water infiltration from above the geomembrane liner. In addition, gases would not likely be generated by the inorganic waste materials; therefore, venting would not be required.

9.4.5 Short-Term Effectiveness

It is anticipated that the construction phase of this alternative would be accomplished within one field season; therefore, impacts associated with construction would likely be short term and minimal. These potential short-term impacts would be mitigated during the construction phase. On-site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur due to the relatively large volumes of waste requiring consolidation and grading. Control of fugitive dust emissions would be provided by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. Short-term impacts to the surrounding community are expected to be minimal. A measurable short-term impact to the surrounding community would include increased vehicular traffic and associated safety hazards in the vicinity of Toston, Montana, in association with the construction. Dust generation may occur in the vicinity of Toston and water application to the roads in the area may be necessary.

9.4.6 Implementability

This alternative is both technically and administratively feasible, and could be implemented within one field season. The consolidation, regrading, and revegetation require conventional construction practices; materials and construction methods are readily available with the exception of a local source for the earthen materials and coversoil (or suitable plant-growth media). Also, design methods and requirements are well documented and understood. Installation of the single geomembrane liner and earthen cap would require the services of a contractor experienced in the proper installation of specialized caps and liners.

Containing the waste materials in place would require the use of heavy equipment including scrapers, loaders, caterpillars, and haul trucks. The heavy equipment required to perform these tasks can be operated on slopes with a maximum steepness of approximately 2:1, and very little of the smelter area approaches this steepness. This type of reclamation alternative could be supplemented in the future with additional reclamation actions such as groundwater control measures. However, future removal of the materials would be more costly after a cap has been installed.

Components or factors which could potentially prolong the implementation of this alternative as planned include: (1) locating an adequate earthen cover material and coversoil (or suitable plant-growth media) source, (2) controlling fugitive dust emissions and storm water discharge during reclamation activities, and (3) addressing landowner concerns. However, these concerns are applicable to other reclamation alternatives being considered for the site.

9.4.7 Costs

The total present worth cost for Alternative 3 (capping in place with an earthen cap) is $346,103.00. The total present worth cost for the second portion of Alternative 3 (capping in place with an earthen cap and geomembrane liner) is $675,873.00. Tables 9-3 and 9-4 present the costs associated with implementing this alternative. The total cost includes the present value of 30 years on annual maintenance and monitoring costs, in addition to the capital costs.

Conceptual Design and Assumptions

The smelter area would be regraded and recontoured to reestablish surface water drainage channels, minimize erosion, and achieve positive drainage. Slopes steeper than about 4:1 would be regraded using small terrace benches, dozer basins, and pits to minimize soil erosion and enhance revegetation efforts.

Revegetation of the smelter area would likely take place during the fall season. The seed mixture and fertilizer would be simultaneously drilled into the prepared seed beds. Mulch would be applied to

TABLE 9-3

COST ESTIMATE - ALTERNATIVE 3
CONTAINMENT - EARTHEN CAP
ON-SITE SLAG DISPOSAL
TOSTON SMELTER SITE

Cost Item	Quantity	Unit	Unit Cost	Cost
Capital Costs				
Mobilization, Bonding & Insurance	1.00	LS	25,000.00	25,000.00
Site Preparation and Storm Water Control Improvements	4.30	AC	1,000.00	4,300.00
Waste Grading and Consolidation	3,200.00	CY	2.00	6,400.00
Slag Excavation and Repository	1.00	LS	20,000.00	20,000.00
Lime Incorporation (average 100 tons per acre)	430.00	TON	150.00	64,500.00
Cover Soil (4.3 acres; 18 inch)	10,400.00	CY	6.00	62,400.00
Fertilize, Seed, and Mulch	4.40	AC	2,000.00	8,800.00
Farm Fence	3,000.00	LF	3.00	9,000.00
Repository Fence	400.00	LF	6.00	2,400.00
Cleanup and Demobilization	1.00	LS	2,000.00	2,000.00
Subtotal Construction Costs				204,800.00
Construction Contingencies		15 % of Construction Cost		30,720.00
Engineering Design and Construction Oversight		15 % of Construction Cost		30,720.00
Total Capital Costs				266,240.00
Yearly Operation and Maintenance (O&M) Costs				
Site Inspections	3.00	EA	500.00	1,500.00
Site Maintenance		2 % of Construction Cost		4,096.00
Subtotal O&M Costs				5,596.00
O&M Contingencies		15 %		839.00
Total Yearly O&M Cost				6,435.00
Present Worth of O&M Costs Based on 30 Year Life @ 7.00%		PF Factor = 12.41		79,863.00
Total Present Worth				346,103.00

Assumptions: Unit costs based on professional judgment and recent bids for similar work at the other Montana abandoned mine reclamation projects.

Notes:
LS = Lump Sum
SY = Square Yard
% = Percent
O&M = Operation and Maintenance
AC = Acre
LF = Lineal Feet
EA = Each
PF = Present Worth Factor

TABLE 9-4

COST ESTIMATE - ALTERNATIVE 3
CONTAINMENT - EARTHEN CAP WITH LINER
ON-SITE SLAG REPOSITORY
TOSTON SMELTER SITE

Cost Item	Quantity	Unit	Unit Cost	Cost
Capital Costs				
Mobilization, Bonding & Insurance	1.00	LS	25,000.00	25,000.00
Site Preparation and Storm Water Control Improvements	4.30	AC	1,000.00	4,300.00
Waste Grading and Consolidation	3,200.00	CY	2.00	6,400.00
Slag Excavation and Repository	1.00	LS	20,000.00	20,000.00
Lime Incorporation (average 100 tons per acre)	430.00	TON	150.00	64,500.00
Cover Soil (4.3 acres; 18 inch)	10,400.00	CY	6.00	62,400.00
Geomembrane Cover (4.3 acres)	20,800.00	SY	10.00	208,000.00
Fertilize, Seed, and Mulch	4.40	AC	2,000.00	8,800.00
Farm Fence	3,000.00	LF	3.00	9,000.00
Repository Fence	400.00	LF	6.00	2,400.00
Cleanup and Demobilization	1.00	LS	2,000.00	2,000.00
Subtotal Construction Costs				412,800.00
Construction Contingencies		15 % of Construction Cost		61,920.00
Engineering Design and Construction Oversight		15 % of Construction Cost		61,920.00
Total Capital Costs				536,640.00
Yearly Operation and Maintenance (O&M) Costs				
Site Inspections	3.00	EA	500.00	1,500.00
Site Maintenance		2 % of Construction Cost		8,256.00
Subtotal O&M Costs				9,756.00
O&M Contingencies		15 %		1,463.00
Total Yearly O&M Cost				11,219.00
Present Worth of O&M Costs Based on 30 Year Life @ 7.00%		PF Factor = 12.41		139,233.00
Total Present Worth				675,873.00

Assumptions: Unit costs based on professional judgment and recent bids for similar work at the other Montana abandoned mine reclamation projects.

Notes:
LS = Lump Sum
SY = Square Yard
% = Percent
O&M = Operation and Maintenance
AC = Acre
LF = Lineal Feet
EA = Each
PF = Present Worth Factor

promote temporary protection of the disturbed erodible surfaces. Selected areas may be interseeded with bare-root or containerized shrub and tree species. Biodegradable jute netting, or the most appropriate erosion control mat, would be anchored over newly seeded areas with slopes greater than 2.5 to 1 to provide additional stabilization until the vegetation becomes established. Also, any temporary roads constructed at the site would be reclaimed after the field activities are completed.

The following assumptions were used to develop costs directly and to calculate associated costs for this alternative:

- The total surface area requiring consolidation and regrading is approximately 4.3 acres.
- Disposal of solid slag in a 0.1-acre repository on site would include the following steps:
- An estimated 580 cubic yards of solid slag would be excavated and consolidated in the repository using excavators, loaders, and dozers.
- An estimated 300 cubic yards of common borrow soil would be excavated from the repository location and stockpiled on site for later use as the repository earthen cap and smelter area backfill.
- A leachate collection and removal system would be installed in the repository consisting of a three-inch thick layer of washed, coarse gravel and PVC drain pipes.
- A bottom geocomposite liner would be installed in the repository consisting of a geosynthetic clay liner, filter fabric, and geocomposite drainage fabric.
- From acid-base accounting results, solid slag materials would not require lime amending.
- A geocomposite cap consisting of a geosynthetic clay liner and a geocomposite drainage fabric would be placed over the 0.1-acre repository. The geocomposite cap would be covered with 12 inches of common borrow soil totaling 140 cubic yards, and 6 inches of top soil totaling 70 cubic yards.
- A woven wire fence would be placed around the 0.1-acre landfill. The total length of fence required is 400 linear feet.
- All regraded waste areas would be amended with lime to reduce acid-generation potential. From acid-base accounting results, lime would be required at an average rate of about 100 tons per acre.
- Either an earthen cap or an earthen cap with geomembrane would be installed over the regraded waste areas. The graded and contoured areas must be smooth enough to allow the installation of the chosen cap and to maximize the integrity of the cap.

- Common borrow and coversoil sources are located within a 10-mile radius of the site and would not require permitting.
- The total surface area requiring revegetation is approximately 4.4 acres. Some interseeding with bare-root or containerized shrub and tree species would be performed.
- A four-strand, barbed-wire fence would be placed surrounding any revegetated areas to promote plant growth and minimize erosion due to potential vehicular traffic. The total length of fence required to surround the areas is approximately 3,000 linear feet.
- Access roads to, and through, the site would need improvement to allow unobstructed access for heavy equipment.
- Any temporary roads constructed at the site would be obliterated and reclaimed after the field activities are completed.
- Land use restrictions would be implemented to prevent incompatible uses of the site.

9.5 ALTERNATIVE 4: EXCAVATION AND ON-SITE DISPOSAL IN A MODIFIED RCRA REPOSITORY

Under this alternative, all of the smelter waste materials would be excavated and disposed of in an on-site, modified RCRA repository. The steps include the following: (1) excavating and preparing the repository subgrade, (2) installing a geocomposite liner and drainage system, (3) excavating and consolidating the smelter waste materials in the repository, (4) capping the waste with a geocomposite liner and an 18-inch thick earthen cap, and (5) revegetating the repository cap and the disturbed areas. A conceptual design of the modified RCRA repository is shown in Figure 9-2. The repository would comprise an area of approximately 0.6 acres and would be located on the south side of the Toston Smelter site between the Big Spring Ditch and the Missouri River. Average waste depth in the repository would be approximately 9 feet. Repository preparation would involve the excavation of clean, native soils within the repository area and stockpiling of this material for later use in the repository cap. It is estimated that approximately 2,200 cubic yards of soil would require removal in order to locate the repository.

A relatively simple leachate collection and detection system consisting of a coarse gravel drainage layer and perforated PVC piping with monitoring standpipes would be designed as an integral part of the repository liner system. This repository drainage layer and the liner would be installed, and general smelter wastes would then be excavated and placed into the repository. Waste placement would need to proceed cautiously to prevent damage to the liner. As the smelter and slag wastes are placed in the repository, grading and compaction of the waste would be required. The final two feet of waste would be amended with lime to inhibit acid production. A geocomposite cap and 18 inches of soil cover would be placed over the waste.

After the geocomposite cap and soil cover are placed over the smelter waste, the repository slopes would be graded to 4 to 1 slopes or less to minimize surface erosion potential. Next, the disturbed areas would be prepared for revegetation, including the removal areas and the repository cap. The excavated areas would be graded to match the contour of the land surface, and if necessary, cover soil would be applied to the disturbed areas.

Revegetation would likely take place during the fall of the year. The seed mixture and fertilizer would be simultaneously drilled into the prepared seed beds. Mulch would be applied to promote temporary protection of the disturbed erodible surfaces.

Heavy equipment would be required on site to implement this alternative efficiently. Multiple large-capacity haul trucks, bulldozers, front end loaders, excavators, and compactors would be needed to construct the repository and excavate and haul the material.

9.5.1 Overall Protection of Human Health and the Environment

The implementation of this alternative would provide a means of reducing or eliminating the threat of direct contact with the waste material as well as reducing the risk of airborne exposure and soil ingestion. In addition, isolating the waste would provide environmental protection by limiting the infiltration of precipitation and surface water which may leach contaminants to the groundwater.

The threat of direct human exposure would essentially be eliminated by this alternative. The potential for ingestion, dermal contact, and inhalation of soil containing arsenic and lead would be eliminated over the long term. Risks would be reduced to acceptable levels for recreational land uses.

Protection of the environment would be achieved under this alternative. Ecological exposures through all scenarios including deer exposure to lead through ingestion of surface salts, and plant phytotoxicity would also be reduced to acceptable levels or possibly eliminated.

9.5.2 Compliance with ARARS

There are no federal or state contaminant-specific ARARs that are required to be met for containing contaminated smelter waste at the Toston Smelter site. However, removal of the specified waste and disposal in a constructed repository are expected to satisfy federal and state groundwater standards including maximum contaminant levels (MCL) and human health standards (HHS). The contaminants would not be expected to leach to groundwater because the primary waste sources of concern would be physically isolated from groundwater using a liner system and a liner cap.

Implementation of this alternative is expected to satisfy air quality regulations because encapsulating the smelter waste would stabilize the materials with respect to fugitive emissions.

OSHA requirements would be met by requiring appropriate safety training for all on-site workers during the construction phase of the project.

Location-specific ARARs are expected to be met without any conflicts. Contacts with appropriate agencies regarding wetlands, floodplains, and paleontological resources would be required.

All action-specific ARARs are anticipated to be met including the hydrological regulations contained in the Strip and Underground Mine Reclamation Act. The mining wastes were derived from the benificiation and extraction of ores and are, therefore, assumed to be exempt from federal government regulation through RCRA as hazardous waste. In addition, revegetation requirements contained in the Surface Mining Control and Reclamation Act would be met. State of Montana dust suppression and control requirements are applicable for earth-moving activities associated with this alternative for the control of fugitive dust emissions; these requirements would be met through water application to roads receiving heavy vehicular traffic and to excavation areas, if necessary.

9.5.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of the repository is dependent upon proper maintenance, including long-term monitoring and routine inspections, to ensure that the system performs as designed. The repository cap would be the component most vulnerable to any damage or degradation that might occur. Multilayered caps are susceptible to ponding of surface water, erosion, settlement, and disruption of the cover integrity by vehicles, deep-rooting vegetation, and burrowing animals. The actual design life of the repository is not certain; however, since the repository would be periodically inspected, the required maintenance could be determined and implemented. In addition, institutional controls would be required to prevent land uses incompatible with the reclaimed site. Specifically, land uses that would compromise the repository cap should be precluded.

In addition, revegetation of the excavated areas and the repository cap would stabilize the land surface by providing erosion protection from surface water and wind erosion, and would reduce net infiltration through the media by increasing the evapotranspiration process. The long-term effectiveness of this alternative would be enhanced by determining the proper grading layout for the area, selecting good quality soil cover, and selecting the appropriate plant species for revegetation. Long-term effectiveness would likely be improved by selecting metal tolerant plant species adapted to short growing seasons.

9.5.4 Reduction of Toxicity, Mobility or Volume Through Treatment

The objective of this alternative is to provide a reduction in contaminant mobility; the volume or toxicity of the contaminants would not be physically reduced. Placing the smelter waste in a repository would stabilize the source area and reduce and possibly eliminate contaminant mobility from surface water and wind erosion through the use of impermeable liners that encapsulate the smelter waste. The mobility of the contaminants is expected to be reduced to an extent that would result in an overall risk reduction from all pathways and routes of exposure.

9.5.5 Short-Term Effectiveness

It is anticipated that the construction phase of this alternative would be accomplished within one field season; therefore, impacts associated with construction would likely be short term and minimal. These potential short-term impacts would be mitigated during the construction phase. On-site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur due to waste consolidation and grading. Control of fugitive dust emissions would be provided by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. Short-term impacts to people residing or recreating in the vicinity of the site are expected to be minimal. A measurable short-term impact to the surrounding area would include increased vehicular traffic, associated safety hazards, and potential dust generation in the vicinity of Toston, Montana in association with construction.

9.5.6 Implementability

This alternative is both technically and administratively feasible, and could be implemented within one field season. The construction of a lined repository with a multilayered cap is considered a conventional construction practice; materials and construction methods are readily available. Constructing the repository may require the services of a contractor experienced in the proper component installation procedures. Also, design methods and requirements are well documented and understood.

Components or factors which could potentially prolong the implementation of this alternative as planned include: (1) not locating common borrow soil and top soil; the common borrow soil is expected to be gathered from on site and the top soil is expected to be attained from a local source within 10 miles of the site, and (2) addressing landowner concerns.

9.5.7 Costs

The total capital costs for Alternative 4, excavation and on-site disposal in a modified RCRA repository, has been estimated to be $339,756.00. Table 9-5 presents the itemized capital costs associated with implementing this alternative.

Conceptual Design Assumptions

The following assumptions were used to develop costs directly and to calculate associated costs for this alternative:

- Site preparation and surface water runoff control are included with the mobilization charges.
- A 0.6-acre repository would be prepared on site.
- An estimated 6,900 cubic yards of general smelter waste, slag and soil materials would be excavated and consolidated in the repository using scrapers and dozers.

TABLE 9-5

COST ESTIMATE - ALTERNATIVE 4
ON-SITE DISPOSAL - MODIFIED RCRA REPOSITORY WITH AN EARTHEN AND GEOMEMBRANE CAP AND A GEOMEMBRANE LINER
TOSTON SMELTER SITE

Cost Item	Quantity	Unit	Unit Cost	Cost
Capital Costs				
Mobilization, Bonding & Insurance	1.00	LS	25,000.00	25,000.00
Site Preparation and Storm Water Control Improvements	4.30	AC	1,000.00	4,300.00
Repository Excavation (0.6 acres)	2,200.00	CY	2.50	5,500.00
Repository Leachate Collection System	1.00	LS	5,000.00	5,000.00
Repository Geomembrane Cap and Liner Geocomposites	2,600.00	SY	20.00	52,000.00
Waste Excavation, Hauling, Compaction Preparation	6,900.00	CY	6.00	41,400.00
Lime Incorporation (60 tons)	60.00	TONS	150.00	9,000.00
Repository Soil Cover (18 inches)	1,300.00	CY	1.50	1,950.00
Excavation Areas Soil Cover (4.3 acres; 6 inches)	3,500.00	CY	6.00	21,000.00
Fertilize, Seed, Mulch	4.90	AC	2,000.00	9,800.00
Farm Fence	3,000.00	LF	3.00	9,000.00
Repository Fence	760.00	LF	6.00	4,560.00
Cleanup and Demobilization	1.00	LS	2,000.00	2,000.00
Subtotal Construction Costs				190,510.00
Construction Contingencies		15 % of Construction Cost		28,576.00
Engineering Design and Construction Oversight		15 % of Construction Cost		28,576.00
Total Capital Costs				247,662.00
Yearly Operation and Maintenance (O&M) Costs				
Site Inspections	3.00	EA	500.00	1,500.00
Site Maintenance		2 % of Construction Cost		4,953.00
Subtotal O&M Costs				6,453.00
O&M Contingencies		15 %		968.00
Total Yearly O&M Cost				7,421.00
Present Worth of O&M Costs Based on 30 Year Life @ 7.00%		PF Factor = 12.41		92,094.00
Total Present Worth				339,756.00

Assumptions: Unit costs based on professional judgment and recent bids for similar work at the other Montana abandoned mine reclamation projects.

Notes: LS = Lump Sum; AC = Acre; EA = Each; SY = Square Yard; LF = Lineal Feet; PF = Present Worth Factor; % = Percent; O&M = Operation and Maintenance

- An estimated 2,200 cubic yards of common borrow soil would be excavated from the repository location and stockpiled on site for later use as the repository earthen cap and smelter area backfill.

- A leachate collection and removal system would be installed in the repository consisting of a three-inch thick layer of washed, coarse gravel and PVC drain pipes.

- A bottom geocomposite liner would be installed in the repository consisting of a geosynthetic clay liner, filter fabric, and geocomposite drainage fabric.

- From acid-base accounting results, smelter waste materials would require lime amending at an average of 100 tons of lime per acre. Lime would be incorporated by dozer ripper and plowing into the top two feet of material in the repository. The 0.6-acre repository will require 60 tons of lime.

- A geocomposite cap consisting of a geosynthetic clay liner and a geocomposite drainage fabric would be placed over the 0.6-acre repository. The geocomposite cap would be covered with 12 inches of common borrow soil totaling 900 cubic yards, and 6 inches of top soil totaling 450 cubic yards.

- Top soil is assumed to be obtained from an off-site source within 10 miles of the site.

- A total of 4.9 acres of disturbed ground would require revegetation.

- A four-strand barbed-wire fence would surround any revegetated areas to promote plant growth and minimize erosion due to potential vehicular traffic. The total length of fence required to surround the area is estimated to be 3,000 linear feet.

- A woven wire fence would be placed around the 0.6-acre landfill. The total length of fence required is 760 linear feet.

- Access roads to and through the site will not need improvement to allow unobstructed access for heavy equipment.

9.6 ALTERNATIVE 5: EXCAVATION AND OFF-SITE DISPOSAL IN A RCRA SUBTITLE C LANDFILL

Excavation and off-site disposal of contaminated materials in an off-site RCRA Subtitle C landfill involves the same general excavation and surface control measures as discussed in Section 9.5 (Alternative 4), with the addition of off-site transportation and disposal of materials in a licensed RCRA landfill. The basic components of this option include: (1) excavating waste materials, (2) transporting waste materials to a RCRA landfill, (3) disposing of waste materials at the RCRA landfill, (4) grading the site, and (5) revegetating the disturbed area.

Waste materials from smelter site would be excavated to the depth of the uncontaminated, native ground surface. Waste materials would be loaded into over-the-road haul trucks or transferred to trains and transported to a licensed RCRA Subtitle C facility for disposal. For the purposes of cost assumptions, it is assumed that materials would be disposed of at a facility in Oregon or Idaho (the closest facilities to the site).

After the waste sources are excavated and transported off site, the disturbed areas would be revegetated. Revegetation would likely take place during the fall of the year. The seed mixture and fertilizer would be simultaneously drilled into the prepared seed beds. Mulch would be applied to promote temporary protection of the disturbed erodible surfaces. Weed-free wheat or barley straw mulch would be applied over the reclaimed tailings with a tow spreader or pneumatic spreader using tucking and crimping as the anchoring mechanism.

A considerable amount of heavy equipment would be necessary to implement this alternative efficiently. To excavate and haul the material equipment requirements would include, but not be limited to, scrapers, haul trucks, bulldozers, front end loaders, excavators, and compactors.

9.6.1 Overall Protection of Human Health and the Environment

The implementation of this alternative would provide protection of human health by eliminating the threat of direct contact and airborne exposure to waste material through excavation and off-site disposal. Revegetation subsequent to waste removal would stabilize the site by providing erosion protection.

The threat of direct human exposure would be eliminated or reduced to acceptable levels by this alternative, although there would be some short-term risk associated with the transport of waste materials to the RCRA Subtitle C facility. Ingestion, dermal contact, and inhalation of soil containing arsenic and lead would be eliminated or reduced to acceptable levels. Environmental and ecological exposures through all scenarios, including deer ingestion of lead and plant phytotoxicity, would also be reduced to acceptable levels or eliminated.

9.6.2 Compliance with ARARs

There are no federal or state contaminant-specific ARARs that are required to be met for off-site disposal of contaminated mine wastes or soils from the Toston Smelter site. However, removal of the majority of wastes from the site is expected to reduce or eliminate impacts to groundwater and an overall improvement in groundwater quality is expected. Federal and state groundwater standards including MCLs and HHSs are expected to be met over the long term.

Implementation of this alternative is expected to satisfy air quality regulations because few wastes would remain at the site to be subject to wind erosion. Vegetative cover would stabilize wastes remaining at the site with respect to fugitive emissions.

OSHA requirements would be met by requiring appropriate safety training for all on-site workers during the construction phase.

Location-specific ARARs are expected to be met without any conflicts. Contacts with appropriate agencies regarding wetlands, floodplains, and paleontological remains would be required.

All action-specific ARARs are anticipated to be met including the hydrological regulations contained in the Strip and Underground Mine Reclamation Act. The mining wastes were derived from the benificiation and extraction of ores and are therefore assumed to be exempt from federal government regulation through RCRA as hazardous waste. However, due to TCLP exceedances, wastes would need to be transported and disposed of in accordance with RCRA requirements. Revegetation requirements contained in the Surface Mining Control and Reclamation Act would be met. State of Montana dust suppression and control requirements are applicable for earth-moving activities associated with this alternative for the control of fugitive dust emissions. These requirements would be met through water application to roads receiving heavy vehicular traffic and to excavation areas, if necessary.

9.6.3 Long-Term Effectiveness and Permanence

Under this alternative, disposal of wastes in an off-site RCRA landfill would provide long-term and permanent control of the waste materials, contingent upon the effective operation and maintenance of the RCRA facility. Long-term effectiveness of site revegetation would be enhanced by an appropriate grading layout, and by selecting the appropriate plant species for revegetation. Long-term effectiveness would likely be improved by selecting metal tolerant plant species adapted to short growing seasons.

9.6.4 Reduction of Toxicity, Mobility or Volume Through Treatment

The objective of this alternative is to provide maximum reduction of contaminant mobility by removing waste materials from the site. This would be accomplished for all wastes designated for removal and would eliminate the possibility of these wastes contaminating surface water or groundwater in the future. The volume or toxicity of the contaminants would not be physically reduced under this alternative.

9.6.5 Short-Term Effectiveness

It is anticipated that the construction phase of this alternative would be accomplished within one field season; therefore, impacts associated with construction would likely be short-term and minimal. These potential short-term impacts would be mitigated during the construction phase. On-site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur due to the relatively large volumes of waste requiring excavation and loading. Control of fugitive dust emissions would be provided by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. Short-term impacts to the surrounding community are expected to be minimal. Measurable short-term impacts to the surrounding area and the area along the haul route to the RCRA landfill would include increased vehicular traffic, associated safety hazards, potential dust generation, and the potential for a spill along the haul route.

9.6.6 Implementability

This alternative is both technically and administratively feasible, and could be implemented within one field season. The excavation, loading, hauling, grading, and revegetation require conventional construction practices; materials and construction methods are readily available. Construction methods and requirements are well documented and understood.

9.6.7 Costs

The total present worth cost for Alternative 5 is $2,241,485.00 for excavation, hauling, and disposal of wastes in a RCRA Subtitle C landfill. Table 9-6 presents the costs associated with implementing this alternative. The total cost includes the present value of 30 years on annual maintenance and monitoring costs in addition to the capital costs.

Conceptual Design Assumptions

The following assumptions were used to develop costs directly and to calculate associated costs for this alternative:

- An estimated 6,900 cubic yards of waste materials would be excavated and loaded into haul trucks. Excavation would primarily be performed with excavators, bulldozers and loaders.
- Waste materials would be hauled to, and disposed of in, a licensed RCRA Subtitle C landfill in Oregon or Idaho.
- A total of 4.3 acres of disturbed areas would require grading and revegetation. Slopes would be graded to a 3 to 1 gradient, or less.
- A four-strand barbed-wire fence would be placed around any revegetated areas to promote plant growth and minimize erosion due to potential vehicular traffic. The total length of fence required to surround the areas is estimated at 3,000 linear feet.
- Access roads to, and through, the site would not need improvement to allow unobstructed access for heavy equipment.
- Any temporary roads constructed at the site would be obliterated and reclaimed after the field activities are completed.
- Land use restrictions would be implemented to prevent incompatible uses of the site

TABLE 9-6

COST ESTIMATE - ALTERNATIVE 5
OFF-SITE DISPOSAL - RCRA SUBTITLE C LANDFILL
TOSTON SMELTER SITE

Cost Item	Quantity	Unit	Unit Cost	Cost
Capital Costs				
Mobilization, Bonding & Insurance	1.00	LS	25,000.00	25,000.00
Site Preparation and Storm Water Control Improvements	3.00	AC	1,000.00	3,000.00
Waste Excavation and Loading	6,900.00	CY	8.00	55,200.00
Waste Transportation and Disposal	6,900.00	CY	185.00	1,276,500.00
Excavation Areas Soil Cover (4.3 acres; 6 inches)	3,500.00	CY	6.00	21,000.00
Fertilize, Seed, Mulch	4.30	AC	2,000.00	8,600.00
Farm Fence	3,000.00	LF	3.00	9,000.00
Cleanup and Demobilization	1.00	LS	2,000.00	2,000.00
Subtotal Construction Costs				1,400,300.00
Construction Contingencies		15 % of Construction Cost		210,045.00
Engineering Design and Construction Oversight		15 % of Construction Cost		210,045.00
Total Capital Costs				1,820,390.00
Yearly Operation and Maintenance (O&M) Costs				
Site Inspections	3.00	EA	500.00	1,500.00
Site Maintenance (same as Alternative 3)				4,096.00
Subtotal O&M Costs				4,096.00
O&M Contingencies		15 %		4,426.00
Total Yearly O&M Cost				33,932.00
Present Worth of O&M Costs Based on 30 Year Life @ 7.00%		PF Factor = 12.41		421,095.00
Total Present Worth				2,241,485.00

Assumptions: Unit costs based on professional judgment and recent bids for similar work at the other Montana abandoned mine reclamation projects.

Notes:
LS = Lump Sum
SY = Square Yard
% = Percent
O&M = Operation and Maintenance
AC = Acre
LF = Lineal Feet
EA = Each
PF = Present Worth Factor

10.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section compares the reclamation alternatives retained for the Toston Smelter site. The retained alternatives include: (1) Alternative 1 - No Action, (2) Alternative 2 - Institutional Controls, (3) Alternative 3 - Containment and On-Site Slag Disposal, (4) Alternative 4 - Excavation and On-Site Disposal, and (5) Excavation and Off-Site Disposal. The comparison focuses on the two threshold criteria (the relative protectiveness of human health and the environment and the estimated attainment of ARARs) and the primary balancing criteria (Table 10-1). The following sections discuss the relative ability of each alternative to meet the threshold criteria. Table 10-1 lists the ability of each alternative to meet the threshold criteria and the primary balancing criteria.

10.1 THRESHOLD CRITERIA

For the Toston Smelter site, Alternatives 1, 2, 3, 4, and 5 have been retained. Alternative 1 is not protective of human health and the environment. Alternative 2 would inhibit human exposure to site contaminants but would still allow off-site migration of contaminants due to site erosion. Alternative 3 is more protective than Alternatives 1 and 2 because solid slag would be isolated in an on-site repository, installation of an earthen cap or an earthen cap with liner/drainage/geomembrane layer would better isolate other smelter wastes from contact with potential receptors, and it would reduce the potential for dust inhalation and off-site exposure via erosion. Alternative 4 is more protective than Alternative 3 because the construction of an on-site repository for all wastes would better isolate the hazardous materials from contact with potential receptors. Alternative 5 is the most protective of human health and the environment; however, it is also the most costly alternative. The protection provided by Alternative 5 is attained by removing the hazardous constituents from the site.

Revegetation of the site will significantly reduce the risk from inhalation of contaminants for recreational use for the rockhound/goldpanners or other recreational uses. Risks from dermal exposures will also significantly be reduced by the vegetative cover.

Alternatives 2, 3, 4, and 5 will comply with ARARs by isolating the hazardous materials from contact with potential receptors and by reducing the potential for leaching of metals into groundwater. Alternative 1 may not comply with ARARs because it may allow potential receptors to come into contact with hazardous materials and may allow metals to leach into groundwater.

TABLE 10-1

COMPARATIVE ANALYSIS OF ALTERNATIVES
TOSTON SMELTER SOLID MEDIA

Assessment Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Containment and On-Site Slag Disposal	Alternative 4 Excavation and On-Site Disposal	Alternative 5 Excavation and Off-Site Disposal
Overall Protectiveness					
Public Health, Safety, and Welfare	No reduction in risk.	Human exposures expected to be reduced but not eliminated.	Exposures expected to be eliminated.	Exposures expected to be eliminated.	Exposures expected to be eliminated.
Environmental Protectiveness	No protection offered.	Ecological exposures expected to be reduced but not eliminated.	Exposures expected to be eliminated.	Exposures expected to be eliminated.	Exposures expected to be eliminated.
Compliance With ARARs					
Chemical-Specific	None apply.	All chemical-specific ARARs would be met.	All chemical-specific ARARs would be met.	All chemical-specific ARARs would be met.	All chemical-specific ARARs would be met.
Location-Specific	None apply.	All location-specific ARARs would be met.	All location-specific ARARs would be met.	All location-specific ARARs would be met.	All location-specific ARARs would be met.
Action-Specific	None apply.	All action-specific ARARs would be met.	All action-specific ARARs would be met.	All action-specific ARARs would be met.	All action-specific ARARs would be met.
Long-Term Effectiveness and Permanence					
Magnitude of Residual Risk	No reduction in COC levels in any environmental media, except by natural attenuation.	No reduction in COC levels in any environmental media, except by natural dispersion.	Contaminated materials remain on site. Greater risk reduction than Alternative 2.	Contaminated materials remain on site. Greater risk reduction than Alternative 3.	Contaminated materials removed from site. Greatest risk reduction.
Adequacy and Reliability of Controls	No controls over any on-site contamination, no reliability.	Reliability of fence depends upon long-term maintenance. Erosion could cause off-site migration of COCs.	Reliability of caps dependent, in part, upon long-term maintenance.	Reliability of caps dependent, in part, upon long-term maintenance. More reliable than Alternative 3.	Wastes removed from site. No site maintenance required. Most reliable.

TABLE 10-1
(Continued)
COMPARATIVE ANALYSIS OF ALTERNATIVES
TOSTON SMELTER SOLID MEDIA

Assessment Criteria	**Alternative 1** No Action	**Alternative 2** Institutional Controls	**Alternative 3** Containment and On-Site Slag Disposal	**Alternative 4** Excavation and On-Site Disposal	**Alternative 5** Excavation and Off-Site Disposal
Reduction of Toxicity, Mobility, and Volume					
Treatment Process Used and Materials Treated	None.	None.	Lime amendment, soil cover, (or soil and liner cover), repository, and revegetation used to reduce mobility of CoCs.	Lime amendment, repository, and revegetation used to reduce mobility of COCs.	Off-site RCRA Subtitle C landfill used to reduce mobility of COCs. Unknown if wastes may be treated at off-site facility.
Volume of Contaminated Materials Treated	None.	None.	Some waste treated with lime. Approximately 6,900 cubic yards isolated from human and environmental receptors.	Some waste treated with lime. Approximately 6,900 cubic yards effectively isolated from human and environmental receptors.	Approximately 6,900 cubic yards of waste permanently removed from site and effectively isolated from human and environmental receptors.
Expected Degree of Reduction	Minimal, via natural dispersion only (potential for future increases in mobility of contaminants).	Minimal, via natural dispersion only (potential for future increases in mobility of contaminants)	Volume and toxicity of wastes not reduced. Mobility of COCs would be moderately reduced.	Volume and toxicity of COCs not reduced. Mobility of wastes would be significantly reduced; reduction greater than Alternative 3 due to repository design.	Volume and toxicity of COCs not reduced but moved to an off-site location. Greater reduction in mobility of COCs than Alternative 4 due to RCRA Subtitle C design.
Short-Term Effectiveness					
Protection of Community During Reclamation Action	Not applicable.	Dust suppression on road surfaces may be necessary.	Fugitive emissions control may be required during construction.	Fugitive emissions control may be required during construction.	Fugitive emissions control may be required during construction.
Protection of On-Site Workers During Removal Action	Not applicable.	Expected to be sufficient. Safety hazards likely more prevalent than hazards associated with wastes.	Expected to be sufficient. Safety hazards likely more prevalent than hazards associated with wastes.	Expected to be sufficient. Safety hazards likely more prevalent than hazards associated with wastes.	Expected to be sufficient. Safety hazards likely more prevalent than hazards associated with wastes.

TABLE 10-1
(Continued)
COMPARATIVE ANALYSIS OF ALTERNATIVES
TOSTON SMELTER SOLID MEDIA

Assessment Criteria	**Alternative 1** No Action	**Alternative 2** Institutional Controls	**Alternative 3** Containment and On-Site Slag Disposal	**Alternative 4** Excavation and On-Site Disposal	**Alternative 5** Excavation and Off-Site Disposal
Time Until Removal Action Objectives are Achieved	Not applicable.	One field season.	One field season.	One field season.	One field season.
Implementability					
Ability to Construct and Operate	No construction or operation involved.	No difficulties anticipated.	No difficulties anticipated.	No difficulties anticipated.	No difficulties anticipated.
Ease of Implementing More Action if Necessary	This alternative does not inhibit other actions from taking place at the site.	Easily implemented, if determined to be necessary (waste removal, stabilization, armoring, or other methods)	Waste materials located under earthen cap (or earthen cap with liner) and in repository not readily accessed without destroying caps and liners.	Waste materials located within repository not readily accessed without destroying cap and liner. Other site activities outside of repository easily implemented. (additional armoring/ stabilization, or other methods)	Waste materials located off site. Other on-site action could be implementd if necessary (additional armoring/ stabilization, or other methods).
Availability of Services and Capacities	Not applicable.	Available locally and within the state.	Available locally and within the state.	Available locally and within the state.	RCRA facility only available out of state. Other services and capacities available locally and within the state.
Availability of Equipment and Materials	Not applicable.	Available locally and within the state.	Available locally and within the state.	Available locally and within the state.	Available locally and within the state.
ESTIMATED TOTAL PRESENT WORTH COST	**$0.00**	**$89,643.00**	**$346,103.00** **$675,873.00 (w/liner)**	**$339,756.00**	**$2,241,485.00**

Alternative 1 is the least expensive alternative at no cost. Alternative 2 is the next most expensive alternative at an estimated cost of $89,643.00. Alternative 4 is the next most expensive alternative at an estimated cost of $339,756.00. Alternative 3 (soil cap) is the next most expensive alternative at an estimated cost of $346,103.00. Alternative 3 (soil cap) is more expensive than Alternative 4 mainly because the costs for additional cover soil and lime incorporation under Alternative 3 (soil cover) exceed the larger repository costs under Alternative 4. Alternative 3 (soil cap with liner) is the next most expensive alternative at an estimated cost of $675,873.00. The most expensive alternative is Alternative 5 with an estimated cost of $2,241,485.00.

10.2 SUMMARY

Alternative 5 provides the greatest protection of human health and the environment, compliance with ARARs, long-term effectiveness, reduction in mobility, short-term effectiveness, and implementability; however, it would also be the most expensive alternative.

Alternatives 3, and 4 also provide protection of human health and the environment, compliance with ARARs, short-term effectiveness, and implementability. Long-term effectiveness and reduction in mobility under Alternatives 3 and 4 would be less than for Alternative 5 because wastes would be left on site.

10.3 PREFERRED ALTERNATIVE PACKAGE

Because of its combined advantages of protection of human health and the environment, compliance with ARARs, short-term effectiveness, implementability, and cost, Alternative 4 is the preferred alternative. This preferred alternative package would effectively reclaim the Toston Smelter site, is easily implementable, provides a high level of protection to human health and the environment, and is cost effective. The total present worth of this alternative is $309,179.00.

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APPENDIX A

RISK ASSESSMENT TABLES

ECOLOGICAL RISK ASSESSMENT SPREADSHEET FOR ABANDONED MINE SITES

PAGE 6 - COMBINATION OF ECOLOGIC IMPACT QUOTIENTS (EQs)

FOR THE **Toston Smelter Site**

	Aquatic Life-Surface Wate EQ (Acute)	Aquatic Life-Sediment EQ	Deer Ingestion EQ	Plant Phytotoxicity EQ	Total by CoC
Arsenic	0.0000	0.0000	0.0014	11.4600	11.4614
Cadmium	0.0000	0.0000	0.0067	0.7375	0.7442
Chromium III	0.0000	0.0000			0.0000
Copper	0.0000	0.0000	0.0001	2.7200	2.7201
Iron	0.0000				0.0000
Lead	0.0000	0.0000	75.6840	59.5000	135.1840
Mercury	0.0000				0.0000
Nickel	0.0000	0.0000			0.0000
Silver	0.0000				0.0000
Zinc	0.0000	0.0000	0.0000	3.4250	3.4250
TOTAL	0.0000	0.0000	75.6922	77.8425	153.5347

ECOLOGICAL RISK ASSESSMENT SPREADSHEET FOR ABANDONED MINE SITES

PAGE 5 - PHYTOTOXICITY EQ

Toston Smelter Site

	Phytotoxic Soil Conc.* mg/Kg	Phytotoxicity EQ
Arsenic	50	11.4600
Cadmium	8	0.7375
Copper	125	2.7200
Lead	400	59.5000
Zinc	400	3.4250
TOTAL		77.8425

*Upper end of range, from Kabata-Pendias and Pendias, 1989

PAGE 4 - DEER INGESTION EQ

Toston Smelter Site

	Deer Intake Dose Est. Soil + water mg/Kg-day	Deer Ingestion EQ	
Arsenic	0.0091	0.0014	Toxicological effects from ATSDR, 1991a
Cadmium	0.0001	0.0067	Toxicological effects from ATSDR, 1991b
Copper	0.0054	0.0001	Toxicological effects from NAS, 1980
Lead	0.3784	75.6840	Toxicological effects from ATSDR, 1991c
Zinc	0.0218	0.0000	Toxicological effects from Maita et al, 1981
TOTAL		75.6922	

ECOLOGICAL RISK ASSESSMENT SPREADSHEET FOR ABANDONED MINE SITES

PAGE 3 - SEDIMENT QUALITY CRITERIA EQ

Toston Smelter Site

	SQC Effect Range-Medium* mg/Kg	Sediment EQ
Arsenic	85	0.0000
Cadmium	9	0.0000
Chromium III	145	0.0000
Copper	390	0.0000
Lead	110	0.0000
Nickel	50	0.0000
Zinc	270	0.0000
TOTAL		0.0000

* from Long and Morgan, 1991

ECOLOGICAL RISK ASSESSMENT SPREADSHEET FOR ABANDONED MINE SITES

PAGE 2 - AQUATIC LIFE CRITERIA EQ

Toston Smelter Site

	Acute Criteria ug/L	Chronic Criteria ug/L	Acute AWQC EQ	Chronic AWQC EQ
Arsenic	360	190	0.0000	0.0000
Cadmium	18.7	3.4	0.0000	0.0000
Chromium III	5405	644	0.0000	0.0000
Copper	65.4	38.7	0.0000	0.0000
Iron		1000	0.0000	0.0000
Lead	476.8	18.6	0.0000	0.0000
Mercury	2.4	0.012	0.0000	0.0000
Nickel	4582	509	0.0000	0.0000
Silver	44.0		0.0000	0.0000
Zinc	379	343	0.0000	0.0000
TOTAL			0.0000	0.0000

This page calculates AWQC for the hardness values supplied on page 1, column C. Both chronic and acute are calculated in the table; however, the chronic values are for reference only. Chronic criteria are not applicable unless surface water has been sampled over the entire range of hydrologic conditions at the site, and a statistically significant number of samples at each station are averaged to determine the chronic concentrations over time.

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ECOLOGICAL RISK ASSESSMENT SPREADSHEET FOR ABANDONED MINE SITES

PAGE 1 - SITE SPECIFIC INFORMATION

SITE NAME: Toston Smelter Site

	Aquatic Life Maximum Surface Water Conc. ug/L	Assoc. Surface Water Hardness* mg/L	Maximum Sediment Conc. mg/Kg	Deer Ingestion Water Conc. ug/L	Deer Ingestion Phytotoxicity Surface Conc. mg/Kg	Contaminant of Concern ?
Arsenic	0	400	0	0	573	Y
Cadmium	0.00	400	0	0	5.9	N
Chromium III	0.0	400	0	0.0	0	N
Copper	0.0	400	0	0	340	Y
Iron	0	400	0	0	34000	N
Lead	0.0	400	0	0	23800	Y
Mercury	0.00	400	0	0	0.2	N
Nickel	0.0	400	0	0	9	N
Silver	0.00	400	0	0	55.5	N
Zinc	0.0	400	0	0	1370	Y

Note: Minimum hardness=25 mg/L; Maximum=400 mg/L
nhd = not hardness dependent CoCs

All site specific data are entered on page 1; pages 2 through 5 are lookup tables and page 6 presents the resultant EQs.

Enter media concentrations for the site, either areal averages or site maximum concentrations. If a contaminant does not meet the criteria for "contaminant of concern", enter 0 as the concentration or leave it blank (don't leave hardness blan
These criteria are listed below:

1) contaminants associated with and present at the site;
2) contaminants with concentrations significantly above background (generally 3 times higher);
3) contaminants with at least 20% of the measured concentrations above the detection limit; and,
4) contaminants with acceptable QA/QC results applied to the data.

Column B are surface water concentrations for comparison to aquatic life standards. Enter the maximum concentration measured in "real" surface water at the site (i.e. not adit discharges or intermittent water) that aquatic life might live in.

Column C are hardness measurements for the corresponding surface water concentration in column B in mg/L. Note that the minimum hardness for AWQC calculation is 25 mg/L and the maximum is 400 mg/L. Don't leave blank.

Column D are the maximum sediment concentations measured at the site in "real" surface water (not adit discharges or intermittent drainages) for aquatic life impacts.

Column E are surface water concentrations that deer might drink at the site. This includes adit discharges, intermittent drainages, and ponded water, as long as it is accessible by deer.

Column F are surface waste concentrations for both the deer ingestion (salt) scenario and the phytotoxicity scenario. Enter the mean surface concentration of the highest concentration source at the site (generally tailings).

RECREATIONAL RISK ASSESSMENT SPREADSHEET FOR ABANDONED MINE SITES

PAGE 6 - DETERMINATION OF SITE RECREATIONAL HQs AND RISK

FOR THE Toston Smelter Site

Recreational Use = 10 (High)

Non-Carc.	Soil routes Max. HQ	Water routes Max. HQ	Total HQ by CoC
Antimony	0.0674	0.0000	0.0674
Arsenic	91.6409	0.0000	91.6409
Barium	0.0000	0.0000	0.0000
Cadmium	0.0253	0.0000	0.0253
Chromium III	0.0000	0.0000	0.0000
Cobalt	0.0000	0.0000	0.0000
Copper	0.0035	0.0000	0.0035
Cyanide	0.0000	0.0000	0.0000
Iron	0.3200	0.0000	0.3200
Lead	6.0714	0.0000	6.0714
Manganese	0.3767	0.0000	0.3767
Mercury	0.0003	0.0000	0.0003
Nickel	0.0002	0.0000	0.0002
Silver	0.0001	0.0000	0.0001
Zinc	0.0017	0.0000	0.0017
Total Non-Car	98.5074	0.0000	**98.5074**
Carc.	Soil routes	Water routes	Total
Arsenic-Carc	2.13E-02	0.00E+00	2.13E-02
Cadmium-Car	1.52E-07		1.52E-07
TOTAL CARC	2.13E-02	0.00E+00	**2.13E-02**

PAGE 5 - CALCULATION OF HQs AND RISK WITH RECREATIONAL USE VALUE O 10

	RH/GP Waste Rock	ATV/MR Tailings	RH/GP Water Ing	FISHERMAN Fish Ing
Antimony	0.0157	0.0674	0.0000	0.0000
Arsenic	91.6409	1.0070	0.0000	0.0000
Barium	0.0000	0.0000	0.0000	0.0000
Cadmium	0.0253	0.0019	0.0000	0.0000
Chromium III	0.0000	0.0000	0.0000	0.0000
Cobalt	0.0000	0.0000	0.0000	0.0000
Copper	0.0002	0.0035	0.0000	0.0000
Cyanide	0.0000	0.0000	0.0000	0.0000
Iron	0.3200	0.0340	0.0000	0.0000
Lead	0.2950	6.0714	0.0000	0.0000
Manganese	0.0028	0.3767	0.0000	0.0000
Mercury	0.0001	0.0003	0.0000	0.0000
Nickel	0.0002	0.0002	0.0000	0.0000
Silver	0.0000	0.0001	0.0000	0.0000
Zinc	0.0000	0.0017	0.0000	0.0000
Total Non-Car	92.3002	7.5642	0.0000	0.0000
Arsenic-Carc	2.13E-02	2.64E-04	0.00E+00	0.00E+00
Cadmium-Carc		1.52E-07		
TOTAL CARC	2.13E-02	2.64E-04	0.00E+00	0.00E+00

This page calculates soil and water HQs and risk for both the rockhound and ATV rider scenarios. The greater of the two values is reported on Page 6 as the site HQ/risk for that CoC except where the fish consumption route is not possible.

RECREATIONAL RISK ASSESSMENT SPREADSHEET FOR ABANDONED MINE SITES

PAGE 4 - RECREATIONAL CLEANUP LEVELS (Minimum)

Recreational Cleanup Levels for sites with Minimum Recreational Use Score [2 or 0]
Source: AMRB/TetraTech - 02/96

	7 Days RH/GP Soils Ing/Inh mg/Kg (max-50)	7 Days ATV/MR Soils Ing/Inh mg/Kg (max-32)	7 Days RH/GP Water Ing ug/L (max-50)	7 Days FISHERMAN Fish Ing ug/L water (max-42)
Antimony	4186	7429	1457	15357
Arsenic	2307	4064	1093	262
Barium	735714	71071	255714	1000000
Cadmium	12500	22500	1829	475
Chromium III	1000000	1000000	1000000	1000000
Cobalt	1000000	217857	1000000	1000000
Copper	387143	690000	135000	7114
Cyanide	79286	137857	72857	1000000
Iron	1000000	1000000	1000000	1000000
Lead	15714	28000	1571	1179
Manganese	52357	9500	18286	241
Mercury	3143	5271	1093	2
Nickel	209286	372857	72857	16357
Silver	1000000	1000000	1000000	1000000
Zinc	1000000	1000000	1000000	246
Arsenic-Carc	10	16	4.7	1.1
Cadmium-Carc		278		

Non-Carcinogenic HQ @ 1.0
Carcinogenic Risk @ 1.0E-06

Noncarcinogenic CoCs with no available inhalation RfDs used oral RfDs instead for calculation.
CoCs with no cleanup level specified (e.g. Fe) were set to 1,000,000 mg/Kg (unity).

RfDs used by TetraTech are from EPA 1994; some of these have been changed or added since then.

RECREATIONAL RISK ASSESSMENT SPREADSHEET FOR ABANDONED MINE SITES

PAGE 3 - RECREATIONAL CLEANUP LEVELS (Moderate)

Recreational Cleanup Levels for sites with Moderate Recreational Use Score [5]
Source: AMRB/TetraTech - 02/96

	25 Days RH/GP Soils Ing/Inh mg/Kg (max-50)	16 Days ATV/MR Soils Ing/Inh mg/Kg (max-32)	25 Days RH/GP Water Ing ug/L (max-50)	21 Days FISHERMAN Fish Ing ug/L water (max-42)
Antimony	1172	2080	408	4300
Arsenic	646	1138	306	73.4
Barium	206000	19900	71600	1000000
Cadmium	3500	6300	512	133
Chromium III	1000000	1000000	1000000	674000
Cobalt	1000000	61000	1000000	1000000
Copper	108400	193200	37800	1992
Cyanide	22200	38600	20400	1000000
Iron	1000000	1000000	1000000	1000000
Lead	4400	7840	440	330
Manganese	14660	2660	5120	67.4
Mercury	880	1476	306	0.588
Nickel	58600	104400	20400	4580
Silver	1000000	1000000	1000000	1000000
Zinc	880000	1000000	306000	68.8
Arsenic-Carc	2.78	4.34	1.324	0.316
Cadmium-Carc		77.8		

Non-Carcinogenic HQ @ 1.0
Carcinogenic Risk @ 1.0E-06

Noncarcinogenic CoCs with no available inhalation RfDs used oral RfDs instead for calculation.
CoCs with no cleanup level specified (e.g. Fe) were set to 1,000,000 mg/Kg (unity).

RfDs used by TetraTech are from EPA 1994; some of these have been changed or added since then.

RECREATIONAL RISK ASSESSMENT SPREADSHEET FOR ABANDONED MINE SITES

PAGE 2 - RECREATIONAL CLEANUP LEVELS (MAXIMUM)

Recreational Cleanup Levels for sites with Maximum Recreational Use Score [10]
Source: AMRB/TetraTech - 02/96

	50 Days RH/GP Soils Ing/Inh mg/Kg (max-50)	32 Days ATV/MR Soils Ing/Inh mg/Kg (max-32)	50 Days RH/GP Water Ing ug/L (max-50)	42 Days FISHERMAN Fish Ing ug/L water (max-42)
Antimony	586	1040	204	2150
Arsenic	323	569	153	36.7
Barium	103000	9950	35800	1000000
Cadmium	1750	3150	256	66.5
Chromium III	1000000	1000000	511000	337000
Cobalt	1000000	30500	1000000	1000000
Copper	54200	96600	18900	996
Cyanide	11100	19300	10200	1000000
Iron	1000000	1000000	1000000	1000000
Lead	2200	3920	220	165
Manganese	7330	1330	2560	33.7
Mercury	440	738	153	0.294
Nickel	29300	52200	10200	2290
Silver	1000000	1000000	1000000	1000000
Zinc	440000	784000	153000	34.4
Arsenic-Carc	1.39	2.17	0.662	0.158
Cadmium-Carc		38.9		

Non-Carcinogenic HQ @ 1.0
Carcinogenic Risk @ 1.0E-06

Noncarcinogenic CoCs with no available inhalation RfDs used oral RfDs instead for calculation.
CoCs with no cleanup level specified (e.g. Fe) were set to 1,000,000 mg/Kg (unity).

RfDs used by TetraTech are from EPA 1994; some of these have been changed or added since then.

RECREATIONAL RISK ASSESSMENT SPREADSHEET FOR ABANDONED MINE SITES

PAGE 1 - SITE SPECIFIC INFORMATION

SITE NAME: Toston Smelter Site

ional Use from AIMSS : 10 (10=High, 5=Mod., 2=Low)

Does surface water exceed any acute aquatic life criteria ? Y (Y or N)

	Surface Waste Rock Conc. mg/Kg	Surface Coke/Slag Conc. mg/Kg	Surface Water Conc. ug/L	Contaminant of Concern ?
Antimony	9.2	70.1	0	N
Arsenic	29,600	573	0	Y
Barium	0	0	0	N
Cadmium	44.2	5.9	0	N
Chromium III	0	0	0	N
Cobalt	0	0	0	N
Copper	12.6	340	0	N
Cyanide	0	0	0	N
Iron	320000	34000	0	N
Lead	649	23800	0	Y
Manganese	20.5	501	0	N
Mercury	0.035	0.2	0	N
Nickel	5.1	9	0	N
Silver	21.9	55.5	0	N
Zinc	18.8	1370	0	N

All site specific data are entered on this page; pages 2 - 4 are lookup tables and page 6 present the resultant HQs and risk.

Enter "recreational use" value from site AIMSS data (10=high use, 5=moderate use, 2 or 0=low use).
If the AIMSS recreational use value is incorrect or changed, enter the appropriate value.

Answer question regarding acute exceedences. This determines whether the fish ingestion route is a viable exposure.

Enter media concentrations for the site, either areal averages or site maximum concentrations. If a contaminant does not meet the criteria for "contaminant of concern", enter 0 as the concentration or leave it blank.
These criteria are listed below:

1) contaminants associated with and present at the site;
2) contaminants with concentrations significantly above background (generally 3 times higher);
3) contaminants with at least 20% of the measured concentrations above the detection limit; and,
4) contaminants with acceptable QA/QC results applied to the data.

If no waste rock, tailings or surface water are present at a site, enter zeros for concentrations in that medium.

Column B are surficial waste rock concentrations for evaluation of the Rockhound/goldpanner scenario.
Enter the mean surface concentration of the highest concentration waste rock source area at the site.

Column C are surficial tailings concentrations for evaluation of the ATV/motorcyle rider scenario.
Enter the mean surface concentration of the highest concentration tailings source area at the site.

Column D are the maximum surface water concentations measured at the site in "real" surface water (i.e. not adit discharges or intermittent drainages) that might reasonably used for drinking water and fish consumption by the recreational user.

Column E is a determination of contaminants of concern. It is not used for calculation, but is for reference by the user.

APPENDIX B

FEDERAL
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

APPENDIX B - FEDERAL ARARs
CONTENTS

1.0 INTRODUCTION

MDEQ/MWCB has provided a draft document describing ARARs for abandoned mine sites. The potential federal ARARs, advisories, and guidance that may be useful in reclaiming the Toston Smelter site are presented below. The ARARs presented herein have not undergone legal review as they pertain to the Toston Smelter site. Therefore, these potential ARARs should be considered draft.

2.0 FEDERAL CONTAMINANT-SPECIFIC ARARS

2.1 CLEAN AIR ACT (APPLICABLE)

Section 109 of the Clean Air Act (42 USC §7409) and implementing regulations found in 40 CFR Part 50 set national primary and secondary ambient air quality standards. National primary ambient air quality standards define levels of air quality that are necessary, with an adequate margin of safety, to protect the public health. National secondary ambient air quality standards define levels of air quality that are necessary to protect public welfare from any known or anticipated adverse effects of a pollutant. The standards for particulate matter in 40 CFR §50.6 are applicable for reclamation alternatives for the Toston Smelter site, particularly for the excavation, earth moving, regrading, and potential transport of the fine-grained materials. These standards must be met both during the design and implementation phases of the reclamation activities.

Particulate Matter

The ambient air quality standard for particulate matter of less than or equal to 10 micrometers in diameter (PM-10) is 150 micrograms per cubic meter, 24-hour average concentration; 50 micrograms per cubic meter, annual arithmetic mean for particulate matter of less than or equal to 10 micrometers in diameter.

In addition, state law provides an ambient air quality standard for settled particulate matter. Particulate matter concentrations in the ambient air shall not exceed the 30-day average: 10 grams per square meter. Administrative Record of Montana (ARM) §16.8.818 (applicable).

2.2 RESOURCE CONSERVATION AND RECOVERY ACT (APPLICABLE)

Under 40 CFR Part 261, Subpart D, defines the solid wastes (mining-related wastes) which are subject to regulations as hazardous wastes. This requirement is applicable to reclamation alternatives at the Toston Smelter site that involve the treatment, storage, or disposal of hazardous wastes in a solid waste management unit (such as a surface impoundment, waste pile, land treatment unit, or landfill). The limits specified for groundwater protection are the same as the maximum contaminant levels (MCL) for those substances as defined in Section 2.4.

2.3 CLEAN WATER ACT (RELEVANT AND APPROPRIATE)

The Federal Clean Water Act (33 USC §§1387) as amended by the Water Quality Act of 1987 (Public Law 100-4 §103) provides the authority for each state to adopt water quality standards (40 CFR Part 131) designed to protect beneficial uses of each water body and requires each state to designate uses for each water body. EPA regulations require states to establish antidegradation requirements. EPA has provided guidance to the states for this purpose ("Water Quality Criteria Summary"; Quality Criteria for Water 1986 - Update 2 EPA; May 1, 1987). Pursuant to this authority and the criteria established by Montana water quality regulations (ARM §16.20.623), Montana established classification standards for discharge into the major river drainages. These classifications are presented in the State ARARs section.

At this time, EPA is relying on the State standards. EPA reserves the right to identify federal water quality criteria as ARARs for this action, if appropriate.

40 CFR Part 122 establishes the National Pollutant Discharge Elimination System (NPDES). The substantive requirements of general permits for storm water discharges from construction are relevant and appropriate. <u>See</u> 57 Fed. Reg. 41236, September 9, 1992. Montana has an EPA-approved State program (MPDES) that is discussed in the State ARARs section.

2.4 SAFE DRINKING WATER ACT (RELEVANT AND APPROPRIATE)

The Safe Drinking Water Act (SDWA) has established the MCL for chemicals in drinking water distributed in public water systems. SDWA MCLs are not applicable to the reclamation activities at the site because the groundwater and surface water at the site are not a public water supply. The SDWA MCLs are relevant and appropriate at the Toston Smelter site even though the groundwater and surface water are not currently part of a public water system. The Preamble to the National Oil and Hazardous Substance Contingency Plan (NCP) clearly states that the MCLs are relevant and appropriate for groundwater that is a current or potential source of drinking water (55 Fed. Reg. 8750 [March 8, 1990]) and is further supported by requirements of the NCP, 40 CFR §300.430(e)(2)(i)(B). MCLs developed under the SDWA generally are ARARs for current or potential drinking water sources.

Standards for potential contaminants of concern at the Toston Smelter site are:

Chemical	MCLs	Human Health Standards[a]
Arsenic	0.05 (mg/L)	18 (μg/L)
Cadmium	0.005 (mg/L)	5 (μg/L)
Copper	1.3[b] (mg/L)	1,000 (μg/L)
Chromium (Total)	0.1 (mg/L)	100 (μg/L)
Cyanide	0.2 (mg/L)	200 (μg/L)
Lead	0.015[b] (mg/L)	15 (μg/L)
Mercury	0.002 (mg/L)	0.14 (μg/L)

Notes: [a] = MDHES WQB Circular WQB-7 (December, 1995)
[b] = Action level, not an MCL

The EPA has granted to the State of Montana primacy in the enforcement of the SDWA. Thus, the law commonly enforced in Montana is the state law. The state regulations substantially parallel the federal law.

3.0 FEDERAL LOCATION-SPECIFIC ARARS

3.1 NATIONAL HISTORIC PRESERVATION ACT (APPLICABLE)

This statute and implementing regulations (16 USC §470, 36 CFR Part 800, 40 CFR 6.310[b]), require federal agencies or federal projects to take into account the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object that is included in, or eligible for, the Register of Historic Places. Compliance with this ARAR requires consultation with the State Historic Preservation Officer (SHPO), who can identify historic properties and assess whether proposed clean-up actions at the Toston Smelter site will impact these resources.

3.2 ARCHEOLOGICAL AND HISTORICAL PRESERVATION ACT (APPLICABLE)

This statute and implementing regulations (16 USC §469, 40 CFR §6.301[c]) establish requirements for the evaluation and preservation of historical and archaeological data, which may be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program. This requires a survey of the site for covered scientific, prehistorical or archaeological artifacts. Preservation of appropriate data concerning the artifacts is hereby identified as an ARAR requirement, to be completed at the Toston Smelter site during the implementation of the reclamation activities.

3.3 HISTORIC SITES, BUILDINGS AND ANTIQUITIES ACT (APPLICABLE)

This Act (16 USC §§461 et seq.; 40 CFR §6.301[a]) states that "[i]n conducting an environmental review of a proposed EPA action, the responsible official shall consider the existence and location of natural landmarks using information provided by the National Park Service pursuant to 36 CFR §62.6(d) to avoid undesirable impacts upon such landmarks." "National natural landmarks" are defined under 36 CFR §62.2 as:

> Area(s) of national significance located within [the U.S.] that contain(s) an outstanding representative example(s) of the nation's natural heritage, including terrestrial communities, aquatic communities, landforms, geological features, habitats of natural plant and animal species, or fossil evidence of development of life on earth.

Under the Historic Sites Act of 1935, the Secretary of the Interior is authorized to designate areas as National Natural Landmarks for listing on the National Registry of Natural Landmarks. A survey has been conducted at the Toston Smelter site in order to determine whether potential natural landmarks are present.

3.4 PROTECTION OF WETLANDS ORDER (APPLICABLE)

This requirement (40 CFR Part 6, Appendix A, Executive Order No. 11990) mandates Federal agencies and the potentially responsible party (PRP) to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practicable alternative exists. For this project, jurisdictional wetland identification has not been performed; however, wetlands are not likely to exist on the Toston Smelter site. Compliance with this ARAR requires consultation with the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service to determine the presence and extent of wetlands and to ascertain the means and measures necessary to mitigate, prevent, and compensate for project related losses of wetlands.

3.5 ENDANGERED SPECIES ACT (APPLICABLE)

This statute, and implementing regulations (16 USC §§1531-1543, 50 CFR §402, and 40 CFR §6.302[h]), require that any federal activity or federally authorized activity may not jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify critical habitat.

Compliance with this requirement involves consultation with the U.S. Fish and Wildlife Service, resulting in a determination as to whether there are listed or proposed species or critical habitats present at the Toston Smelter site, and, if so, whether any proposed activities will impact such wildlife or habitat. At this time no threatened or endangered species or critical habitat has been identified on the site.

3.6 RESOURCE CONSERVATION AND RECOVERY ACT (APPLICABLE)

The requirements set forth at 40 CFR §264.18(a) and (b) provide that: a) any hazardous waste facility must not be located within 61 meters (200 feet) of a fault; and b) any hazardous waste facility within the 100-year floodplain must be designed, constructed, operated, and maintained to avoid washout. Any discrete disposal or storage facilities which remain on site as part of reclamation alternatives at the Toston Smelter site must meet these standards.

4.0 FEDERAL ACTION-SPECIFIC ARARS

4.1 HAZARDOUS MATERIALS TRANSPORTATION ACT (APPLICABLE)

The Hazardous Materials Transportation Act (49 USC §§1801-1813), as implemented by the Hazardous Materials Regulations (49 CFR Parts 10, 171-177), regulates the transportation of hazardous materials. The regulations may be applicable to reclamation alternatives at the Toston Smelter site, if non-exempt (Bevill) hazardous mining waste is transported off site, via public highways on site, or by rail.

4.2 RESOURCE CONSERVATION AND RECOVERY ACT

Criteria for Classification of Solid Waste Disposal Facilities Practices (Applicable)

The criteria contained in 40 CFR Part 257 (Subtitle D) are used in accordance with RCRA guidance in determining which practices pose a reasonable probability of having an adverse effect on human health or the environment. RCRA Subtitle D establishes criteria which are, for the most part, environmental performance standards that are used by states to identify unacceptable solid waste disposal practices or facilities.

Regulation 40 CFR Part 257.3-2 provides for the protection of threatened or endangered species.

Regulation 40 CFR Part 257.3-3 provides that the facility shall not cause the discharge of pollutants into waters of the United States; this includes dredged or fill materials.

Regulation 40 CFR Part 257.3-4 states that a facility or practice shall not contaminate underground drinking water beyond the solid waste boundary.

Standards Applicable to Transporters of Hazardous Waste (Applicable)

The regulations in 40 CFR Part 263 establish standards that apply to persons that transport hazardous waste within the U.S. If any hazardous waste is transported from the Toston Smelter site via rail-line or public highway, these regulations will be applicable.

Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (Applicable)

The regulations in 40 CFR Part 264 establish minimum national standards which define the acceptable management of hazardous waste for owners and operators of facilities which treat, store, or dispose of hazardous waste. These standards could be applicable to reclamation alternatives at the Toston Smelter site that incorporate the treatment, storage or disposal of hazardous waste on site.

A. Releases from Solid Waste Management Units

The regulations in 40 CFR 264, Subpart F, establish requirements for groundwater protection for RCRA-regulated solid waste management units (such as waste piles, land treatment units, and landfills). Subpart F provides for three general types of groundwater monitoring: detection monitoring, compliance monitoring, and corrective action monitoring. Monitoring is required during the active life of a hazardous waste management unit.

B. Closure and Post-Closure

40 CFR Part 264, Subpart G, establishes that hazardous waste management facilities must be closed in such a manner as to: a) minimize the need for further maintenance; and b) control, minimize or eliminate, to the extent necessary, to protect public health and the environment, post-closure escape of hazardous wastes, hazardous constituents, leachate, contaminated runoff or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.

C. Waste Piles

Regulation 40 CFR Part 264, Subpart L, applies to owners and operators of facilities that store or treat hazardous waste in piles.

D. Land Treatment

The requirements of 40 CFR Part 264, Subpart M, regulate the management of "land treatment units" that treat or dispose of hazardous waste; these requirements would be relevant and appropriate for any land treatment units established at the site.

E. Landfills

Regulation 40 CFR Part 264, Subpart N, applies to entities that dispose of hazardous waste in landfills. The regulations specify appropriate liner systems and leachate collection systems for landfills, run-on and run-off management systems, and wind dispersal controls for landfills. These regulations set forth specific requirements for landfill monitoring and inspection, surveying and recordkeeping, and closure and post-closure care.

4.3 CLEAN WATER ACT (RELEVANT AND APPROPRIATE)

40 CFR Part 122 establishes the NPDES. The substantive requirements of general permits for storm water discharges from construction are relevant and appropriate. See 57 Fed. Reg. 41236, September 9, 1992. Montana has an EPA-approved State MPDES permit system that is discussed in the State ARARs section (Appendix C).

4.4 SURFACE MINING CONTROL AND RECLAMATION ACT (RELEVANT AND APPROPRIATE)

This Act (30 USC §§1201-1326) and implementing regulations found at 30 CFR Parts 816 and 784 establish provisions designed to protect the environment from the effects of surface coal mining operations, and to a lesser extent, non-coal mining. These regulations require that revegetation be used to stabilize soil covers over reclaimed areas. The reclamation performance standards are relevant and appropriate to reclaimed mine sites.

APPENDIX C

STATE OF MONTANA
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

APPENDIX C - STATE ARARS
CONTENTS

1.0 INTRODUCTION

MDEQ/MWCB has provided a draft document describing ARARs for abandoned mine sites. Potential State of Montana ARARs specific to the Toston Smelter site are presented below. This list of ARARs, although specific to the Toston Smelter site, may be modified or substantially changed once a reclamation action is chosen or implemented.

2.0 MONTANA CONTAMINANT-SPECIFIC ARARS

2.1 MONTANA WATER QUALITY ACT (APPLICABLE)

Under the state Water Quality Act, §§75-5-101 et seq., MCA, the legislature has promulgated regulations to preserve and protect the quality of surface waters in the state. These regulations classify state waters according to quality, place restrictions on the discharge of pollutants to state waters, and prohibit the degradation of state waters. The requirements listed below are applicable water quality standards with which any reclamation activity must comply.

Surface Water Quality Standards and Procedures (Applicable)

ARM 17.30.610(1) (Applicable) provides that specified waters in the Missouri River drainage, including Spring Creek, are classified B-1 for water use. The standards for B-1 classification waters are contained in ARM 17.30.623 (Applicable) of the Montana Water Quality regulations. These standards place limits on fecal coliform content, dissolved oxygen concentration, pH balance, turbidity, water temperature, sediments, solids, oils, and color. Concentrations of toxic and deleterious substances which would remain in the water after conventional treatment cannot exceed MCLs, and concentrations of toxic and deleterious substances cannot exceed department circular WQB-7 levels. The B-1 classification standards also contain the specific language:

- During periods when the daily maximum water temperature is greater than 60°F, the geometric mean number of organisms in the fecal coliform group must not exceed 200 per 100 milliliters (ml), nor are 10 percent of the total samples during any 30-day period to exceed 400 fecal coliform per 100 ml.
- Dissolved oxygen concentration must not be reduced below 7.0 milligrams per liter (mg/L).

- Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 8.5 must be less than 0.5 pH unit. Natural pH outside this range may not be altered, and natural pH above 7.0 must be maintained above 7.0.

- Temperature variations are specifically limited, depending upon the temperature range of the receiving water.

- No increase in naturally occurring concentrations of sediment, settleable solids, oils, or floating solids is allowed which will or is likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish, or other wildlife.

- True color must not be increased more than five units above naturally occurring color.

Additional restrictions on any discharge to surface waters are included in:

ARM 17.30.635 (Applicable), which requires that industrial waste must receive, as a minimum, treatment equivalent to the best practicable control technology currently available (BPCTCA) as defined in 40 CFR Subchapter N and subsequent amendments. Industrial waste is defined in Section 75-5-103, MCA as any waste substance from the process of business or industry or from the development of any natural resource, together with any sewage that may be present This section also requires that in designing a disposal system, stream flow dilution requirements must be based on the minimum consecutive 7-day average flow which may be expected to occur on the average of once in 10 years.

ARM 17.30.637 (Applicable), which prohibits discharges containing substances that will:

(a) settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines;

(b) create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials;

(c) produce odors, colors or other conditions which create a nuisance or render undesirable tastes to fish flesh or make fish inedible;

(d) create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life;

(e) create conditions which produce undesirable aquatic life.

ARM 17.30.637 also provides that leaching pads, tailing ponds, or water, waste, or product holding facilities must be located, constructed, operated and maintained to prevent any discharge, seepage, drainage, infiltration, or flow which may result in pollution of state waters, and a monitoring system may be required to ensure such compliance. No pollutants may be discharged and no activities may be conducted which, either alone or in combination with other wastes or activities, result in the total dissolved gas pressure relative to the water surface exceeding 110 percent of saturation.

Reclamation alternatives for the Toston Smelter site should be evaluated with respect to the "prohibitions" set out in 17.30.637.

ARM 17.30.640 provides that discharges to surface waters may be granted a mixing zone on a case by case basis by the DEQ in accordance with its written implementation policy. In granting a mixing zone, the department shall ensure (a) that chronic toxicity does not result outside of the mixing zone, (b) the extent of the mixing zone is minimized to the extent practicable, and (c) the granting of a mixing zone does not affect existing or reasonably anticipated uses outside of the mixing zone.

<u>Nondegradation of Water Quality</u> (Applicable)

The Water Quality Act and regulations also include nondegradation provisions which require that waters which are of higher quality than the applicable classification be maintained at that high quality, and discharges which would degrade that water are prohibited. Montana's standard for nondegradation of water quality is applicable for all constituents for which pertinent portions of the Missouri River are of higher quality than the B-1 classification. If any reclamation activity constitutes a new source of pollution or an increased source of pollution, the nondegradation standard requires the degree of waste treatment necessary to maintain the existing water quality for constituents that are of higher quality than the applicable classification.

ARM 17.30.702 (Applicable) defines "degradation" and provides that "nonpoint source pollutants from lands where all reasonable land, soil and water management or conservation practices have been applied are not considered degradation."

ARM 17.30.705 (Applicable) applies nondegradation requirements to any activity of man which would cause a new or increased source of pollution to state waters. This section states when exceptions to nondegradation requirements apply, except that in no event may such degradation affect public health, recreation, safety, welfare, livestock, wild birds, fish and other wildlife or other beneficial uses.

Montana Pollutant Discharge Elimination System (MPDES) (Applicable)

The MPDES standards (the substantive requirements to be enforced through the permitting process) are set out in 17.30.1201, et seq. These standards are all simply incorporations of the federal regulations.

ARM 17.30.1203 (Applicable) adopts and incorporates the provisions of 40 CFR Part 125 for criteria and standards for the imposition of technology-based treatment requirements in MPDES permits. Although the permit requirement would not apply to on-site discharges, the substantive requirements of Part 125 are applicable, that is, for toxic and nonconventional pollutants treatment must apply the best available technology economically achievable (BAT); for conventional pollutants, application of the best conventional pollutant control technology (BCT) is required. Where effluent limitations are not specified for the particular industry or industrial category at issue, BCT/BAT technology-based treatment requirements are determined on a case by case basis using best professional judgment (BPJ). See CERCLA Compliance with Other Laws Manual, Vol. I, August 1988, p. 3-4 and 3-7.

The MPDES permit requirements are technically not applicable to remedial actions at CERCLA sites because ARM 17.30.1310(3) exempts "any discharge in compliance with the instructions of an on-scene coordinator pursuant to 40 CFR Part 300 et seq. (the NCP)." This exemption is even broader than the 121(e) permit exemption, because it would apply even to an off-site discharge, if such discharge were "in compliance with the instructions of the on-site coordinator (OSC)." The MPDES requirements could still be relevant and appropriate to discharges of pollutants as part of an abandoned mine reclamation activity. However, it would probably be more appropriate to identify the federal requirements as relevant and appropriate because of the express state exemption, which arguably represents a determination that the state MPDES requirements are not relevant or appropriate. Note that this analysis does not apply to a site being addressed only under CECRA and not CERCLA, because the exemption applies only to the instructions of an OSC under the NCP.

Montana Groundwater Pollution Control System (Applicable)

ARM 17.30.1002 (Applicable) classifies groundwater into Classes I through IV based on the present and future most beneficial uses of the groundwater, and states that groundwater is to be classified according to actual quality or actual use, whichever places the groundwater in a higher class. Class I is the highest quality class; class IV the lowest.

ARM 17.30.1003 (Applicable) establishes the groundwater quality standards applicable with respect to each groundwater classification. Dissolved concentrations of toxic, carcinogenic, bioconcentrating, and harmful substances in Class I or II groundwater (or Class III groundwater which is used as a drinking water source) may not exceed WQB-7 human health standards. This requirement effectively makes the current WQB-7 values applicable and not just relevant and appropriate requirements. Concentrations of other dissolved or suspended substances must not exceed levels that render the waters harmful, detrimental or injurious to public health. Maximum allowable concentration of these substances also must not exceed acute or chronic problem levels that would adversely affect existing or designated beneficial uses of groundwater of that classification.

ARM 17.30.1011 (Applicable) provides that any groundwater whose existing quality is higher than the standard for its classification must be maintained at that high quality unless the board is satisfied that a change is justifiable for economic or social development and will not preclude present or anticipated use of such waters.

2.2 CLEAN AIR ACT (APPLICABLE OR RELEVANT AND APPROPRIATE)

Air quality regulations pursuant to the Act, §§75-2-101 et seq., MCA, are discussed below.

ARM 16.8.815 (Applicable) specifies that no person shall cause or contribute to concentrations of lead in the ambient air which exceed the following: 90-day average--1.5 micrograms per cubic meter of air, 90-day average, not to be exceeded.

ARM 16.8.818 (Applicable) specifies that no person shall cause or contribute to concentrations of particulate matter in the ambient air such that the mass of settled particulate matter exceeds the following 30-day average: 10 grams per square meter, 30-day average, not to be exceeded.

ARM 16.8.821 (Applicable) specifies that no person may cause or contribute to concentrations of PM-10 in the ambient air which exceed the following standard:

1. 24-hour average: 150 micrograms per cubic meter of air, 24-hour average, with no more than one expected exceedance per calendar year.
2. Annual average: 50 micrograms per cubic meter of air, expected annual average, not to be exceeded.

ARM 16.8.1401(3) and (4) (Applicable) states that no person shall cause or authorize the production, handling, transportation or storage of any material unless reasonable precautions to control emissions of airborne particulate matter are taken.

ARM 16.8.1404 (Applicable) states that "no person may cause or authorize emissions to be discharged in the outdoor atmosphere . . . that exhibit an opacity of twenty percent (20%) or greater averaged over six consecutive minutes."

ARM 16.8.1424 (Applicable) adopts the standards of 40 CFR Part 61 setting forth emission standards for hazardous air pollutants.

ARM 26.4.761 (Relevant and Appropriate) requires that a fugitive dust control program be implemented in reclamation operations, and lists specific but non-exclusive measures as necessary components of such a program.

2.3 OCCUPATIONAL HEALTH ACT (APPLICABLE)

The occupational safety and health laws, including the Occupational Health Act, §§50-70-101 et seq., MCA, are applicable protections for employees working at abandoned mine sites. The occupational health laws prescribe certain limits of exposure considered necessary to protect the health of those with sustained exposure to specified substances. The nature of this removal action may subject persons other than employees to exposures sustained throughout the work period. These limits must also be considered relevant and appropriate for those living or present in the areas affected by the reclamation action.

ARM 16.42.102 (Applicable) establishes maximum threshold limit values for air contaminants under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects. In accordance with this rule, no worker (or other person in or near the work site) shall be exposed to air contaminant levels in excess of the threshold limit values listed in each of the tables below. Compliance with the rule is determined by calculating the person's exposure to air contaminants as individual substances or as the exposure to a mixture of substances in accordance with formulas established by this rule. A person's exposure to any contaminant in the following table, shall at no time exceed the threshold limit value listed:

Air Contaminant	Concentration (milligrams per cubic meter)
Arsenic and compounds (as As)	0.5
Copper dust and mist	1.0
Lead	0.15
Manganese	5.0
Molybdenum Soluble compounds Insoluble compounds	 5.0 15.0
Selenium compounds (as Se)	0.2
Silver, Metal and soluble compounds	0.01

2.4 PUBLIC WATER SUPPLIES ACT

EPA has granted to the State of Montana primacy in enforcement of the Safe Drinking Water Act. The state regulations under the state Public Water Supply Act, §§75-6-101 et seq., MCA, substantially parallel the federal law.

Public Water Supply Regulations (Relevant and Appropriate)

Note that ARM 17.38.204(3) specifies MCLs that are included in two separate sections of the federal regulations: 40 CFR §141.12 and 40 CFR §141.61.

ARM 17.38.205 (Relevant and Appropriate) establishes the following maximum turbidity contaminant level for public water supply systems which use surface water in whole or in part:

(1) One turbidity unit (NTU), as determined by a monthly average, except that a level not exceeding 5 NTU may be allowed if the supplier of water can demonstrate to the department that the higher turbidity does not:

- a) interfere with disinfection;
- b) prevent maintenance of an effective disinfectant agent throughout the distribution system; or
- c) interfere with microbiological determination.

(2) 5 NTU based on an average for two consecutive days.

Groundwater in the shallow aquifer beneath the Toston Smelter site could potentially be used as a drinking water source in the future. Therefore, this ARAR is relevant and appropriate.

ARM 17.30.1206 (Relevant and Appropriate) adopts and incorporates language for toxic pollutant effluent standards found in 40 CFR Part 129.

ARM 17.30.1207 (Relevant and Appropriate) adopts and incorporates language for effluent limitations and standards of performance found in 40 CFR Subchapter N (Parts 401-471, except Part 403).

3.0 MONTANA LOCATION-SPECIFIC ARARS

3.1 FLOODPLAIN AND FLOODWAY MANAGEMENT ACT (RELEVANT AND APPROPRIATE)

Section 76-5-401, MCA, (Relevant and Appropriate) specifies the uses permissible in a floodway and generally prohibits permanent structures, fill, or permanent storage of materials or equipment. Section 76-5-402, MCA, generally provides that permanent structures are allowed in the floodplain, excluding the floodway, if they are permitted and meet certain minimum standards.

Section 76-5-403, MCA, (Relevant and Appropriate) generally provides that permanent structures are allowed in the floodplain excluding the floodway, if they are permitted and meet certain minimum standards.

Floodplain Management Regulations (Relevant and Appropriate)

Section 36-15-216, MCA, (Relevant and Appropriate) consists of the factors to consider in determining whether a permit should be issued to establish or alter an artificial obstruction or nonconforming use in the floodplain or floodway.

Section 36-15-602, MCA, (Relevant and Appropriate) specifies conditions for allowing obstruction in the floodway and lists uses requiring permits.

Section 36-15-603, MCA, (Relevant and Appropriate) states that proposed diversions or changes in the place of diversion must be evaluated by the Department of Natural Resources and Conservation (DNRC) to determine whether they may significantly affect flood flows and, therefore, require a permit.

Section 36-15-604, MCA, (Relevant and Appropriate) prohibits new artificial obstructions or nonconforming uses that will increase the upstream elevation of the flood base 0.5 feet or significantly increase flood velocities.

Section 36-15-605, MCA, (Relevant and Appropriate) identifies artificial obstruction and nonconforming uses that are prohibited within the designated floodway except as allowed by permit, and includes "a structure or excavation that will cause water to be diverted from the established floodway, cause erosion, obstruct the natural flow of water, or reduce the carrying capacity of the floodway." Solid waste disposal and storage of highly toxic, flammable, or explosive materials are also prohibited.

Section 36-15-606, MCA, (Relevant and Appropriate) identifies flood control works that are allowed within the designated floodway pursuant to permit and certain conditions. Flood control levies and flood walls, riprap, channelization projects, and dams are examples of flood control works.

Section 36-15-701, MCA, (Relevant and Appropriate) describes allowed uses in the flood fringe.

Section 36-15-703, MCA, (Relevant and Appropriate) describes prohibited uses within the flood fringe (such as, areas in the floodplain but outside of the designated floodway). For example, solid waste disposal and storage of highly toxic, flammable or explosive material is prohibited.

3.2 NATURAL STREAMBED AND LAND PRESERVATION ACT (RELEVANT AND APPROPRIATE)

Natural Streambed and Land Preservation Standards (Relevant and Appropriate)

Section 87-5-501, MCA, (Relevant and Appropriate) declares that the fish and wildlife resources of the state of Montana, particularly the fishing waters within the state, are to be protected and preserved to the end that they be available for all time, without change, in their natural existing state except as may be necessary and appropriate after due consideration of all factors involved.

3.3 ANTIQUITIES ACT (RELEVANT AND APPROPRIATE)

Section 22-3-424, MCA, (Relevant and Appropriate) requires that the identification and protection of heritage properties and paleontological remains on lands owned by the state are given appropriate consideration in state agency decision making. Portions of the Toston Smelter site are located on privately owned land. The Antiquities Act is applicable only to state lands, but is relevant and appropriate in decision making affecting other properties. Heritage property is defined in §22-3-421, MCA, as any district, site, building, structure, or object located upon or beneath the earth or under water that is significant in American history, architecture, archaeology, or culture.

Section 22-3-433, MCA, (Relevant and Appropriate) requires that evaluation of environmental impacts include consultation with the historic preservation officer concerning the identification and location of heritage properties and paleontological remains on lands that may be adversely impacted by the proposed action. The responsible party, in consultation with the historic preservation officer and the preservation review board, shall include a plan for the avoidance or mitigation of damage to heritage properties and paleontological remains to the greatest extent practicable. (Applicable only to state lands, but is relevant and appropriate in decision making affecting other properties).

Section 22-3-435, MCA, (Relevant and Appropriate) requires any person conducting activities, including survey, excavation, or construction, who discovers any heritage property or paleontological remains or who finds that an operation may damage heritage properties or paleontological remains shall promptly report to the historic preservation officer the discovery of such findings and shall take all reasonable steps to ensure preservation of the heritage property or paleontological remains. (Applicable only to state lands, but is relevant and appropriate in decision making affecting other properties).

Cultural Resources Regulations (Relevant and Appropriate)

ARM 12.8.503 and ARM 12.8.505 through 12.8.508 (Relevant and Appropriate) prescribe specific procedures to be followed to ensure adequate consideration of cultural values in agency decision-making.

4.0 MONTANA ACTION-SPECIFIC ARARS

4.1 CLEAN AIR ACT (APPLICABLE)

Air Quality Regulations (Applicable)

Dust suppression and other similar actions may be necessary to control the release of substances into the air as a result of excavation, earth moving, regrading, and potential transport of mine wastes both off and on site. The ambient air standards for specific contaminants and for particulates are set forth in the federal contaminant-specific section above. The levels of certain substances that may not be exceeded are identified in the Air Quality section of the contaminant-specific state ARARs. Additional air quality regulations under the state Clean Air Act, §§75-2-101 et seq., MCA, are discussed below.

ARM 16.8.815 (Applicable) specifies that no person shall cause or contribute to concentrations of lead in the ambient air which exceed the following: 90-day average--1.5 micrograms per cubic meter of air, 90-day average, not to be exceeded.

ARM 16.8.1302 (Applicable) lists certain wastes that may not be disposed of by open burning, including oil or petroleum products, RCRA hazardous wastes, chemicals, and treated lumber and timbers.

ARM 16.8.1401-1404 (Applicable) states that no person shall cause or authorize the production, handling, transportation, or storage of any material unless reasonable precautions to control emissions of airborne particulate matter are taken.

ARM 26.4.761 (Relevant and Appropriate) specifies measures that must be implemented to control fugitive dust emissions during certain reclamation activities. Such measures would be relevant and appropriate requirements to control fugitive dust emissions during excavation, earth moving, regrading, and transportation activities conducted as part of the reclamation of the site.

4.2 WATER QUALITY ACT (APPLICABLE)

Section 75-5-605, MCA, makes it unlawful to cause pollution of any State waters or to place or cause to be placed any wastes in a location where they are likely to cause pollution of any State waters.

Surface Water Quality Standards and Procedures (Applicable)

ARM 17.30.610(1) (Applicable) provides that specified waters in the Missouri River drainage, are classified as B-1 for water use. The standards for B-1 classification waters are contained in ARM 17.30.623 (applicable) of the Montana Water Quality regulations. These standards place limits on fecal coliform content, dissolved oxygen concentration, pH balance, turbidity, water temperature, sediments, solids, oils, and color. Concentrations of toxic and deleterious substances which would remain in the water after conventional treatment cannot exceed MCLs, and concentrations of toxic and deleterious substances cannot exceed WQB-7 levels.

Additional restrictions on any discharge to surface waters are included in:

ARM 17.30.635 (Applicable), which requires that industrial waste must receive, as a minimum, treatment equivalent to the best practicable control technology currently available (BPCTCA) as defined in 40 CFR Subchapter N and subsequent amendments. Industrial waste is defined in Section 75-5-103, MCA as any waste substance from the process of business or industry or from the development of any natural resource, together with any sewage that may be present This section also requires that in designing a disposal system, stream flow dilution requirements must be based on the minimum consecutive 7-day average flow which may be expected to occur on the average of once in 10 years.

ARM 17.30.637 (Applicable), which prohibits discharges containing substances that will:

(a) settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines;

(b) create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials;

(c) produce odors, colors or other conditions which create a nuisance or render undesirable tastes to fish flesh or make fish inedible;

(d) create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life;

(e) create conditions which produce undesirable aquatic life.

ARM 17.30.637 also provides that leaching pads, tailing ponds, or water, waste, or product holding facilities must be located, constructed, operated and maintained to prevent any discharge, seepage, drainage, infiltration, or flow which may result in pollution of state waters, and a monitoring system may be required to ensure such compliance. No pollutants may be discharged and no activities may be conducted which, either alone or in combination with other wastes or activities, result in the total dissolved gas pressure relative to the water surface exceeding 110 percent of saturation.

Reclamation alternatives for the Toston Smelter site should be evaluated with respect to "prohibitions" set out in 17.30.637.

ARM 17.30.640 provides that discharges to surface waters may be granted a mixing zone on a case by case basis by the department in accordance with its written implementation policy. In granting a mixing zone, the department shall ensure, (a) that chronic toxicity does not result outside of the mixing zone, (b) the extent of the mixing zone is minimized to the extent practicable, and (c) the granting of a mixing zone does not affect existing or reasonably anticipated uses outside of the mixing zone.

Nondegradation of Water Quality (Applicable)

The Water Quality Act and regulations also include nondegradation provisions which require that waters which are of higher quality than the applicable classification be maintained at that high quality, and discharges which would degrade that water are prohibited. Montana's standard for nondegradation of water quality is applicable for all constituents for which pertinent portions of affected surface waters are of higher quality than the I classification. If any reclamation activity constitutes a new source of pollution or an increased source of pollution, the nondegradation standard requires the degree of waste treatment necessary to maintain the existing water quality for constituents that are of higher quality than the applicable classification.

ARM 17.30.702 (Applicable) defines "degradation" and provides that "nonpoint source pollutants from lands where all reasonable land, soil and water management or conservation practices have been applied are not considered degradation."

ARM 17.30.705 (Applicable) applies nondegradation requirements to any activity of man which would cause a new or increased source of pollution to state waters. This section states when exceptions to nondegradation requirements apply, except that in no event may such degradation affect public health, recreation, safety, welfare, livestock, wild birds, fish and other wildlife or other beneficial uses.

Montana Pollutant Discharge Elimination System (MPDES) (Applicable)

The MPDES standards (the substantive requirements to be enforced through the permitting process) are set out in 17.30.1201, et seq. These standards are all simply incorporations of the federal regulations.

ARM 17.30.1203 (Applicable), which adopts and incorporates the provisions of 40 CFR Part 125 for criteria and standards for the imposition of technology-based treatment requirements in MPDES permits.

Although the permit requirement would not apply to on-site discharges, the substantive requirements of Part 125 are applicable, that is, for toxic and nonconventional pollutants treatment must apply the best available technology economically achievable (BAT); for conventional pollutants, application of the best conventional pollutant control technology (BCT) is required. Where effluent limitations are not specified for the particular industry or industrial category at issue, BCT/BAT technology-based treatment requirements are determined on a case by case basis using best professional judgment (BPJ). See CERCLA Compliance with Other Laws Manual, Vol. I, August 1988, p. 3-4 and 3-7.

ARM 17.30.1206 (Relevant and Appropriate) adopts and incorporates language for toxic pollutant effluent standards found in 40 C.F.R. Part 129. ARM 17.30.1207 (Relevant and Appropriate) adopts and incorporates language for effluent limitations and standards of performance found in 40 C.F.R. Subchapter N (Parts 401-471, except Part 403).

The MPDES permit requirements are technically not applicable to remedial actions at CERCLA sites because ARM 17.30.1310(3) exempts "Any discharge in compliance with the instructions of an on-scene coordinator pursuant to 40 CFR Part 300 et seq. (the NCP)." This exemption is even broader than the 121(e) permit exemption, because it would apply even to an off-site discharge, if such discharge were "in compliance with the instructions of the OSC." The MPDES requirements could still be relevant and appropriate to discharges of pollutants as part of an abandoned mine reclamation activity. However, it would probably be more appropriate to identify the federal requirements as relevant and appropriate because of the express state exemption, which arguably represents a determination that the state MPDES requirements are not relevant or appropriate. Note that this analysis does not apply to a site being addressed only under CECRA and not CERCLA, because the exemption applies only to the instructions of an OSC under the NCP.

Montana Groundwater Pollution Control System (Applicable)

ARM 17.30.1002 (Applicable) classifies groundwater into Classes I through IV based on the present and future most beneficial uses of the groundwater, and states that groundwater is to be classified to actual quality or actual use, which ever places the groundwater in a higher class. Class I is the highest class; class IV is the lowest.

ARM 17.30.1003 (Applicable) establishes the groundwater quality standards applicable with respect to each groundwater classification. Concentrations of dissolved toxic and deleterious substances in certain classes of groundwater which is used for drinking water supplies may not exceed Montana WQB-7 human health standards. Concentrations of other dissolved or suspended substances must not exceed levels that render the waters harmful, detrimental or injurious to public health. Maximum allowable concentration of these substances also must not exceed acute or chronic problem levels that would adversely affect existing or designated beneficial uses of groundwater of that classification.

ARM 17.30.1011 (Applicable) provides that any groundwater whose existing quality is higher than the standard for its classification must be maintained at that high quality unless the board is satisfied that a change is justifiable for economic or social development and will not preclude present or anticipated use of such waters.

4.3 GROUNDWATER ACT (APPLICABLE)

Section 85-2-505, MCA precludes the wasting of groundwater. Any well producing waters that contaminate other waters must be plugged or capped, and wells must be constructed and maintained so as to prevent waste, contamination, or pollution of groundwater.

4.4 SOLID WASTE MANAGEMENT ACT (APPLICABLE OR RELEVANT AND APPROPRIATE)

Several regulations promulgated under the Solid Waste Management Act, §§75-10-201 et seq., MCA, are discussed in the federal section of ARARs, because the state implements that federal program.

Solid Waste Management Regulations (Applicable or Relevant and Appropriate)

ARM 16.14.504 (Applicable) restricts the types of wastes that disposal sites may handle.

ARM 16.14.505 (Applicable) sets forth standards that all solid waste disposal sites must meet.

ARM 16.14.508 (Relevant and Appropriate) is the provision that establishes the solid waste management system license application. Although a license would not be required for reclamation activities conducted entirely on site, the information required by this section is relevant and appropriate.

ARM 16.14.509 (Applicable) sets forth that every proposed solid waste management system must be evaluated, taking into consideration the physical characteristics of the disposal site, the types and amount of waste, the operation and maintenance plan for the system, and the plan for reclamation and the land's ultimate use.

ARM 16.14.520 and 16.14.521 (Applicable) set forth the general and specific operation and maintenance requirements for solid waste management systems.

ARM 16.14.523 (Applicable) specifies that solid waste must be transported in such a manner as to prevent its discharge, dumping, spilling or leaking from the transport vehicle.

4.5 HAZARDOUS WASTE MANAGEMENT ACT (RELEVANT AND APPROPRIATE)

Several regulations promulgated under the Hazardous Waste Management Act, §§75-10-401 et seq., MCA, are discussed in the federal section of ARARs, because the state implements that federal program.

ARMs 16.44.109, 16.44.110 and 16.44.113 (Relevant and Appropriate) establish permit conditions, including monitoring, record keeping requirements, operation and maintenance requirements, sampling and monitoring requirements and the option for MDEQ to establish additional permit conditions on a case-by-case basis.

ARMs 16.44.119 and 16.44.120 (Relevant and Appropriate) state the required contents of a Hazardous Waste Management (HWM) permit application. The informational and substantive requirements of these provisions are relevant and appropriate.

ARMs 16.44.701 through 16.44.703 (Relevant and Appropriate) establish hazardous waste management facility standards and requirements.

4.6 STRIP AND UNDERGROUND MINE RECLAMATION ACT (RELEVANT AND APPROPRIATE)

The Toston Smelter site is an abandoned hardrock mine site. Regulations promulgated under Montana's Strip and Underground Mine Reclamation Act, §§82-4-201 et seq., MCA, provide detailed guidelines for addressing the impacts of mine reclamation activities and earth moving projects and may be relevant and appropriate for addressing these impacts in MWCB reclamation projects.

ARM 26.4 (Relevant and Appropriate) provides requirements for backfilling, grading, hydrology, topsoiling, revegetation, and protection of wildlife and air resources.

5.0 OTHER MONTANA LAWS

The following laws may apply to actions being conducted at the Toston Smelter site. While not an exhaustive list, they are included because they identify related concerns that must be addressed and, in some cases, may require some advance planning. They are not included as ARARs because they are not "environmental or facility siting laws." As applicable laws other than ARARs, they are not subject to ARAR waiver provisions.

The administrative/substantive distinction used in identifying ARARs applies only to ARARs and not to other applicable laws. Thus, even the administrative requirements (for example, notice requirements) of these laws must be complied with in this action. Similarly, fees that are based on something other than issuance of a permit are applicable.

5.1 MONTANA SAFETY ACT (APPLICABLE)

Sections 50-71-201, 202 and 203, MCA, state that every employer must provide and maintain a safe place of employment, provide and require use of safety devices and safeguards, and ensure that operations and processes are reasonably adequate to render the place of employment safe. The employer must also do every other thing reasonably necessary to protect the life and safety of its employees. Employees are prohibited from refusing to use or interfering with the use of safety devices.

5.2 EMPLOYEE AND COMMUNITY HAZARDOUS CHEMICAL INFORMATION ACT (APPLICABLE)

Sections 50-78-201, 202, and 204, MCA, state that each employer must post notice of employee rights, maintain at the work place a list of chemical names of each chemical in the work place, and indicate the work area where the chemical is stored or used. Employees must be informed of the chemicals at the work place and trained in the proper handling of the chemicals.

5.3 WATER RIGHTS

Section 85-2-101, MCA, declares that all waters within the State are the State's property, and may be appropriated for beneficial uses. The wise use of water resources is encouraged for the maximum benefit to the people and with minimum degradation of natural aquatic ecosystems.

Parts 3 and 4 of Title 85, MCA, set out requirements for obtaining water rights and appropriating and utilizing water. All requirements of these parts are laws which must be complied with in any action using or affecting waters of the state. Some of the specific requirements are set forth below.

Section 85-2-301, MCA, of Montana law provides that a person may only appropriate water for a beneficial use.

Section 85-2-302, MCA, specifies that a person may not appropriate water or commence construction of diversion, impoundment, withdrawal or distribution works therefor except by applying for and receiving a permit from the Montana DNRC. While the permit itself may not be required under federal law, appropriate notification and submission of an application should be performed and a permit should be applied for in order to establish a priority date in the prior appropriation system.

Section 85-2-306, MCA, specifies the conditions on which groundwater may be appropriated, and, at a minimum, requires notice of completion and appropriation within 60 days of well completion. Section 85-2-311, MCA, specifies the criteria which must be met in order to appropriate water and includes requirements that:

(1) there are unappropriated waters in the source of supply;
(2) the proposed use of water is a beneficial use; and
(3) the proposed use will not interfere unreasonably with other planned uses or developments.

Section 85-2-402, MCA, specifies that an appropriator may not change an appropriated right except as provided in this section with the approval of the DNRC.

Section 85-2-412, MCA, provides that, where a person has diverted all of the water of a stream by virtue of prior appropriation and there is a surplus of water, over and above what is actually and necessarily used, such surplus must be returned to the stream.

5.4 GROUNDWATER ACT

Section 85-2-516, MCA, states that within 60 days after any well is completed a well log report must be filed by the driller with the DNRC and the appropriate county clerk and recorder. Monitoring wells may be installed under some reclamation alternatives being considered for the Toston Smelter site.

5.5 WATER WELL CONTRACTORS

ARM 36.21.402 provides that any person who drills or otherwise constructs water wells must have a State license.

ARM 36.21.403, 36.21.405, 36.21.406 and 36.21.411 provide requirements for obtaining a license, contents of an application, and bonding requirements.

5.6 CONSTRUCTION STANDARDS

ARM 36.21.635 through 36.21.680 set forth water well construction criteria, public water supply wells criteria, well location requirements, and reporting requirements.

ARM 36.21.701 and 36.21.703 specify that monitoring well constructors must be licensed and must verify their experience.

5.7 OCCUPATIONAL HEALTH ACT OF MONTANA

The occupational safety and health laws, including the Occupational Health Act, §§ 50-70-101 § 1910.95 et seq., MCA, are applicable protections for employees working at abandoned mine sites. ARM 16.42.101 provides that no worker shall be exposed to noise levels in excess of the following values (expressed in decibels measured on the A-weighting network [dbA]):

Continuous of Intermittent Noise Exposures	
Duration per day (in hours)	**Noise Level (dbA)**
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
¾	107
½	110
¼	115

These values apply to the total time of exposure per working day regardless of whether this is one continuous exposure or a number of short-term exposures. If a worker is exposed to noise levels in excess of these values, feasible administrative or engineering controls must be used by the employer to reduce noise levels. If these controls are inadequate, the employer must provide personal hearing protective equipment to achieve the foregoing maximum permissible noise exposure levels. This regulation is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR §1910.95 applies.

ARM § 16.42.102 addresses occupational air contaminants. The purpose of this rule is to establish maximum threshold limit values for air contaminants under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects. In accordance with this rule, no worker shall be exposed to air contaminant levels in excess of the threshold limit values listed in the regulation. This regulation is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR §1910.1000 applies.